DOCUMENT RESUME

ED 219 267 SE 038 773

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TITLE Adapting Science for Hearing Impaired Early Adolescents. Final Report.
INSTITUTION West Virginia Univ., Morgantown. Coll. of Human Resources and Education.
SPONS AGENCY National Science Foundation, Washington, D.C.
PUB DATE 81
GRANT SPI-80-05430
NOTE 99p.; For related document, see ED 213 176.

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Curriculum Development; Curriculum Evaluation; *Elementary School Science; Elementary Secondary Education; *Hearing Impairments; Program Development; Program Evaluation; Science Education; *Science Programs; *Secondary School Science
IDENTIFIERS Science Education Research

ABSTRACT

This project developed an effective science curriculum, "Science for the Hearing Impaired" (SFHI), through adaption of two Houghton Mifflin science programs for use with hearing impaired adolescents (ages 9-13). This adaption included reorganization of objectives and content within lessons, deliberate and appropriate teaching of science processes and inquiry skills, multi-sensory presentation of content through active participation, paraphrasing of text and use of language and identification cards, a selected science vocabulary taught through active experience, a variety of communication techniques, and a placement and evaluation system for science learning designed around the capabilities of the hearing impaired. Results from a 1981 trial period were used to produce a final edition of the program, the first available program at the national level providing early adolescent hearing-impaired students with an easily accessible and effective science curriculum adapted to their specific needs. Additional assessment of student progress included cognitive development level, pre-post unit tests of science learning and language development, and science interests and attitudes. Included are the project's developmental and evaluation processes, evaluation results, and in five appendices: project activities/staff listings, trial center descriptions, evaluation instruments, and media material guide to accompany use of the SFHI program. (Author/JN)

SFHI

Final Report

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National Science Foundation
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This material is based upon work supported by the National Science Foundation under grant No. SPI-80-05430. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Contents

Adapting Science Curricula for Hearing Impaired Early Adolescents

ABSTRACT

Currently, science is generally taught to hearing impaired students without the use of curriculum materials or directly from curricula designed for hearing children requiring major expenditures of effort and time for teachers. This project developed an effective science curriculum, Science for the Hearing Impaired (SFHI) through adaptation of two Houghton Mifflin science programs for use with hearing impaired early adolescents, 9-13 years of age. This adaptation included reorganization of objectives and content within lessons, deliberate and appropriate teaching of science processes and inquiry skills, multi-sensory presentation of content through active participation, paraphrasing of text and use of language and identification cards, a selected science vocabulary taught through active experience, a variety of communication techniques, and a placement and evaluation system for science learning designed around the capabilities of the hearing impaired.

Students and teachers from a national sample of rural, suburban, and urban schools for the hearing impaired used the SFHI Program during a trial period, the 1980-81 school year. Results from this testing were used in completing the final edition of the SFHI Program. This program, the first available at the national level, provides early adolescent hearing-impaired students with an easily accessible effective science curriculum adapted to their specific needs.

Additional assessment of student progress included; 1) cognitive developmental level, 2) pre-post unit tests on science learning and language development, and science interests and attitudes.

The students, as a result of the program experience, found science to be both comprehensible and interesting. Skills and knowledge acquired will enable them to successfully pursue further study of science and thereby develop basic life skills and make careers in science and related fields a realistic possibility.

DEVELOPMENTAL PROCESS

Objectives

A review of literature, research, and practice in the field provided a basic framework for the development of a science program for hearing impaired early adolescents. Using concepts regarding the development of thought and language; implications of this development on curriculum and instruction for hearing impaired students, general strategies for curriculum development in use over the past decade, and curriculum and instruction guidelines from science education, the project objectives were proposed and carried out (Sunal and Sunal, 1980). The project objectives were;

1. to adapt a commercially-available curriculum for effective use with hearing impaired early adolescents.
2. to incorporate within the curriculum, procedures and activities which provide an environment which places value upon science and thereby encourages development of attitudes which made science an important part of life and planning for future careers.
3. to disseminate final teacher adaptation guides and support materials to schools for the hearing impaired, interested school systems, and professional organizations.

Thus, an effective and acceptable commercially available science program was selected and adapted for use with hearing impaired early adolescent students, aged 9-13. Important student outcomes stressed in the materials and evaluated for in the trial classrooms were development of skills, interests and attitudes relating to science and overall progress in cognitive and language development.

State of the Art

The first step in the developmental process involved analysis of characteristics of existing science programs in schools primarily concerned with hearing-impaired students in the United States.

The sample studied involved 55% of hearing impaired residential schools in the United States, educating about ½ of the hearing impaired population in the United States, ages 5-18 years of age. The results as reported by Sunal and Burch (1982) in "School Programs for the Hearing Impaired" are summarized as follows: 1) 21% of the schools teach no science, 2) 45% teach basically unmodified public school science, 3) 34% use a science program specifically developed in some aspect for the hearing impaired, 4) 17% use programs oriented towards, or deliberately teach science process or inquiry skills, 5) 20% use programs which attempt some sort of structural sequence, and 6) 15% use programs which have specific strategies of teaching and evaluating science for the hearing impaired.

Each of the areas described in items 4-6 above are highly desirable, as indicated in the general body of science education literature and in specific objectives delineated by the National Science Teachers Association. However, usually the classroom teacher is expected to accomplish them with little assistance. Neither the curriculum materials in use nor the school curriculum structure, in the available evidence analyzed, provided an adequate support system for the teacher.

Non-residential or public schools with hearing impaired students in attendance also lack science programs designed for the hearing impaired. Additional analysis of the support systems in these schools is needed.

Selecting an Appropriate Curriculum Format and Procedure for Adaptation

Using the Curriculum Analysis Guidelines instrument (Sunal and Burch, 1982) science curricula used by, and available to, public and hearing impaired residential schools were analyzed. This analysis led to the criteria used in the final selection of a science curriculum to be adapted in the project. The survey analysis indicated that no commercially produced materials were available which were specifically designed for the hearing impaired. These curricula generally assumed too large of a linguistic repertoire, consisted of activities which need to be selectively supplemented, and made few allowances for visual representation of taped materials. Some appeared to have potential for successful modification. Analysis of in-house, locally developed science curricula designed for hearing impaired students indicated that all had structural defects or problems that may seriously affect successful science teaching with the hearing impaired in non-local settings.

Summarizing these results, at least six problem areas were found to be associated with the use of traditional science programs with hearing impaired youth. The problem areas were;

1. emphasis on facts and memorization vs. skills and science processes.
2. activity with known results vs. discovery and unknown results.
3. primary emphasis on reading materials v.s active participation in meaningful activities.
4. appropriate content materials adapted for the hearing impaired student.
5. difficult language and terminology which is confusing or unknown to the hearing impaired student.
6. abstract concept level.

This project attempted to address these problem areas in developing an effective science program and establishing a model for curriculum development for hearing impaired youth. Criteria for the selection of a potentially adaptable curriculum and final program development were based on; 1) the preceding research in the literature, 2) a national survey, 3) previous formative and summative science program implementation results, and 4) analyses of available science programs. The selection and development criteria were;

1. an instructional system, content and skills to be taught and a program evaluation system which addresses the level of cognitive and affective needs of the hearing impaired student,
2. deliberate teaching of appropriate science processes and inquiry skills,
3. structured sequential objectives presented throughout units,
4. language and vocabulary, important in achieving high student performance in the program, is to be deliberately selected, identified for easy reference, indexed, signed for total communication use and taught through active experience.
5. visual, manipulative and experiential presentation of program content, and
6. student evaluation strategies appropriate to the needs of the hearing impaired student.

Twenty-three science programs showing the best potential for use with the hearing impaired were analyzed for possible adaptation. Using the Curriculum Analysis Guidelines instrument and the criteria developed from the above literature searches and studies, the selection process was concluded with the acceptance of two programs published by the Houghton Mifflin Company. Science (Berger, 1979), formally Modular Activity Program in Science - MAPS, and Spaceship Earth (McLaren, 1980) were found to provide the most appropriate base program and greatest potential for adaptation for hearing impaired/ language delayed youth.

SFHI Program Development

The SFHI Program development process was carried out by a number of curriculum developers and teachers of the hearing impaired. This process followed guidelines derived from the criteria previously stated. The process was finalized through planning conferences and meetings of the project staff, preliminary testing of lessons and short units, and teacher interviews. The developmental sequence is displayed in Appendix B, Project Activities Listing. Project staff are listed in Appendix A.

The SFHI Program was developed using two basic methods; 1) selection and modification of lessons in the existing Houghton Mifflin science programs, and 2) creation of new lessons and materials. Both of these methods were used to support project objectives and development criteria and the original Houghton Mifflin goals.

The adaptation process started with a thorough analysis of the curriculum materials for appropriateness for use with the hearing impaired. This was followed by selection, modification, and creation of new materials as deemed appropriate. The adaptation centered around a learning scheme which involved:

1. familiarization through exploration (Introduction),
2. purposeful teaching of lesson objectives in a concrete manner appropriate to student needs (Development), and
3. multiple use of the ideas gained in a variety of situations (Application and Evaluation).

The three-phase sequence is especially useful with hearing impaired students since these students typically find reading and learning abstract and difficult. This learning sequence provides ample opportunity for first-hand experience with new concepts and skills so that students not only read about new ideas but get involved with them. A more traditional approach used in many science programs involves explaining the concept first, followed by practicing the concept. This

approach was used in the schools studied in this project and was found to delay student learning by as much as two to four years.

The Introduction phase was designed as an activity-oriented exploration. It gives students an opportunity to experience concretely, gather information, relate to past experience, and make discoveries by themselves. Within each cluster or section of the SFHI Program the first lesson(s) begin here. Sometimes whole clusters provide an exploration for ideas introduced later.

In the Development phase new skills and concepts were designed to be presented to the students. Learning is promoted by concrete explanation through a variety of appropriate experiences and is closely related to the exploration activity. Development takes place in the middle or central lessons within each cluster or section.

Enrichment lessons are also included. These lessons provide additional introduction and development of the learning sequence in different areas to facilitate transfer.

The third phase of the sequence, Application, was designed to encourage students to apply the new concept to examples not directly referred to in the Development phase. It provides for learning through repetition and practice. In this way students can begin to extend the range of applicability of the new concept. In each cluster or section Application lessons occur at the end and may involve a number of lessons.

An Evaluation lesson is also included in each cluster. Students are expected to be able to apply concepts and skills they have just gained, rather than simply memorize facts learned in previous lessons. In this way, meaningful understanding rather than rote "learning" is being encouraged and evaluated.

The three-phase learning sequence is efficient only if students are working at an appropriate level matched to their stage of development. Typically, students are grouped for instruction according to reading, achievement, or IQ scores. With the hearing impaired this is particularly inappropriate since such measures are language based. The authors suggest pretesting students at the beginning of the school year using an appropriate test of problem-solving and thinking ability. This procedure minimizes language as a prerequisite in grouping and matching students to program level. By noting similarity in scores, appropriate placement within similar groups at a specific level of the program is possible. During the field testing of this program, the "Inventory of Piaget's Developmental Tasks," a paper and pencil standardized test, was used and proved to be effective for grouping. For further details on testing and grouping, contact the program authors.

Five key types of adaptation occurred. They were:

1. reorganization of objectives, lessons, and content within lessons,
2. paraphrasing,
3. identification of key words and phrases,
4. use of identification cards, and
5. use of language cards.

The first type of adaptation, reorganization, took place as necessary and was based on program goals, development criteria and the results of field testing of objectives, lessons, and content within lessons. However, the basic integrity of the Houghton Mifflin program was maintained. Within the program, changes were made to suit the needs of hearing impaired students while accomplishing the objectives as described in the original curriculum. Numerous activities were added to the existing science programs to help reinforce concepts concretely. The order of lessons was changed, where appropriate, so that the students could have concrete experiences with a concept before it was introduced. Lessons that were considered too abstract or ambiguous were omitted.

Paraphrasing was a second form of adaptation used. Many hearing impaired students have a low reading vocabulary or are not familiar with either multiple meanings of words or multiple words for the same things. The complexity of phrases, sentence construction, or paragraphs also poses great problems for language delayed youth. Therefore, the teacher must use a variety of types of paraphrasing when text materials and directions are present in lessons. Suggestions for paraphrasing were included in the adapted teacher's guide. While reading and/or teacher paraphrasing of the text is part of most lessons, textual content is also presented in a variety of ways, student involvement is encouraged and interest is increased.

Key Words and Phrases, the third type of adaptation strategy, were isolated for each lesson. This included scientific terms as well as words typically difficult for hearing impaired youth. The Key Words and Phrases appear on the first page of a lesson for ease of reference and for special instructional consideration by the teacher. SFHI is activity-oriented. Language interaction is constantly encouraged through teacher-student dialogue and small group work. New vocabulary is not just memorized but is used repeatedly throughout the program so that the student will begin to internalize it, generalize the terms across lessons, and eventually use them spontaneously.

For schools utilizing signing, an added feature was designed in the form of videotapes in which the Key Words and Phrases isolated in each lesson were signed. These Signed Vocabulary and Language Videotapes are useful for introducing unfamiliar and technical signs to the teacher or student. A Signed Vocabulary and Language Videotape Index is available which lists all Key Words and Phrases in one list.

The use of Identification Cards and Language Cards are two additional instructional methods which were also important parts of the adaptation process. Examples include "aquarium" and "chameleon". All key objects relating to each science lesson should be labeled on an Identification Card made with a felt marker on a rectangular piece of posterboard or oaktag. The continued visual impact of the Identification Cards on or near materials used in the lesson reinforces vocabulary learning in the students.

Language Cards are strips of stiff paper on which questions and sentences are written. These accompany the key lesson questions and statements of the teacher, oral and/or signed. Students are given additional support for involvement in discussion and activities. Suggestions for Identification and Language Cards and encouragement of their use are included in the Teacher's Guide for each SFHI Program level.

In addition to emphasis on visual display of language being communicated, several strategies designed to foster language development were utilized. These included the use of concrete examples incorporating multiple senses, encouragement of group interaction, and planned lesson sequence patterns using the learning scheme discussed earlier.

Additional activities were included in the adaptation to make it useful with students in the range of reading, experience, and attention levels. As with instruction activities, evaluation strategies were selected which were not factually oriented but which stressed a variety of responses to a posed learning situation..

Once the key types of adaptation were instituted, an Experimental Edition of the SFHI Program was produced. This version represented a planned, continuous trial program based on the project guidelines developed for hearing impaired early adolescent youth. Concepts, skills, and vocabulary are introduced,

developed, and reinforced throughout the program, building a consistent pattern of meaningful learning in the student's mind and within the science program of the school.

EVALUATION PROCESS

Field Testing of Experimental Edition of SFHI

The developmental process was followed by trial classroom introduction and evaluation of use with a national sample of hearing impaired youth. Field testing began with workshops for the center teachers before, or at the beginning of, the school year. The purpose of the workshops was to provide; 1) instruction in important program goals and in methods of effective science teaching used in the program, 2) training in the use of the program components, and 3) an overview of coordination of program components and use of the project evaluation and reporting instruments. Just reading or listening to a description of the program was deemed inadequate. Familiarization included activities such as sample lesson materials, enagaging in laboratory activities, planning methods of involvement of students in learning and comparing ideas with peers.

The workshops were administered by the project co-directors and the three project supervisors. The workshop included eleven major topic areas as shown on Table 1.

TABLE 1

SFHI Workshop Outline

I. Summary of the Project
   A. Goals.
   B. Procedure
II. Summary of Curriculum
   A. Goals
   B. Activities
III. Development of Reasoning in Students
   A. How Students Think
   B. Concrete and Formal Reasoning Patterns
   C. Self Regulation and the Learning Cycle
   D. Textbooks, Lab Activities, and Tests
IV. Science Curricula and Lessons Traditionally Used in Schools
V. Pretesting and Posttesting
   A. Science Interest Survey
   B. Student's Developmental Level Survey
VI. Introduction to the SFHI Curriculum
   A. Adaptation Components
      1. Overview of Format for Clusters and Lessons
      2. Specific Components Emphasized
      3. Review of Modifications in Various Grade Levels
   B. Demonstration of Adapted Lesson (live and on videotape)
   C. Language Adaptations
VII. In Depth Review of Adapted Curriculum Components
   A. Equipment
   B. Audio-Visual Materials
   C. Evaluation
   D. Signed Vocabulary and Language Videotapes and Index
VIII. Comparing the Adapted Program to Unadapted Materials
IX. Additional Curriculum Modification to Local Conditions
   A. [illegible] Areas and Data Records
   B. Building a Student Evaluation Profile
X. Individual Planning
   A. Distribution of Related Materials
   B. Individual Review and Preparation for First Months Activities in Grades Taught
   C. Individual Review and Listing of Needs for Completion of Units 1-4 for Levels to be Taught
XI. Feedback on Areas Covered in Workshop and in the SFHI Program

Selection of Students and Organization of Centers for Field Trial of the SFHI Program

The target population for the SFHI Program was hearing impaired early adolescents. Of primary concern were students who are severly (70-90 decibels) or profoundly (91 or more decibels) hearing impaired. Because of special conditions affecting hearing impaired students, participants for trial evaluation of the SFHI Program were selected from each of three schools administering programs to over 800 students. The total U.S. hearing impaired student population, ages 2-18, is about 300,000 (Kirk, 1978). About one-half of this total attend systems in their home area. Approximately 128,000 hearing impaired students are classified as early adolescents. The study population represents about one percent of these early adolescents.

The special conditions affecting the selection were;

1) availability of a large enough sample of hearing impaired adolescents to test each level of the program. Most public school settings have few hearing impaired students at any one level, (i.e., 1-8 students).

2) availability of students with divergent backgrounds and needs. Most residential schools draw students from a large geographic area with economic and cultural differences.

3) school settings reflecting different patterns of attendance and needs. Schools located in urban, suburban, and rural areas were involved.

A trial evaluation under these special conditions allowed for maximizing the generalizability of the usefulness of the final SFHI Program with students of differing backgrounds and needs.

The centers finally selected were the West Virginia Schools for the Deaf and Blind (WVSD), a rural school in Romney, West Virginia; the Kendall Demonstration School (KDS), an urban school in Washington, D.C.; and the Arkansas School for the Deaf (ASD) in Little Rock, Arkansas, a suburban

school. See Appendix C for a description of each school setting.

Priority for selection of approximately forty sample study students from each school were;

1) severe to profound hearing loss
2) ages 9-13
3) identified at the concrete or formal cognitive performance level,
4) some familiarity with fingerspelling, American Sign Language, and/or speechreading, and
5) involved in a science class in the school indicating some interest in a science-oriented career.

Using these criteria at each school, students were ranked and selected. In some instances, due to the small number available, all students meeting the criteria at a specific program level were chosen. In others, approximately one-third of the students were chosen. Some younger, 8 and 9, and older, 15, students along with students with a hearing loss as low as 60 db were selected to avoid breaking up an intact class group functioning at a common level.

Overall, 135 students were selected from the schools. Each school was designated as a center and a system was set up for coordination including the participant students, teachers involved in the classes, and the center project supervisor. Table 2 summarizes statistical information for each center. Trial students were those experiencing the SFHI Program in their classrooms. Control students were involved in the regular school science program planned as a normal part of the school's curriculum.

Overall program evaluation involved meetings of project staff for planning and feedback and a communication system described in Figure 1. During times when immediate or direct feedback was planned, the center coordinators worked directly with students and the directors contacted center coordinators.

TABLE 2

SUMMARY TABLE OF CENTERS INVOLVED WITH TRIAL EVALUATION OF THE SFHI PROGRAM

CENTER:	WVSD	KDS	ASD	TOTAL
Number of Students	58	27	50	135
SFHI Program (Trial)	40	15	43	98
Regular Program (Control)	18	12	7	37
Number of Teachers	4	1	5	10
Sex of Students				
Boys	33	15	26	74
Girls	25	12	24	61
Student DB Hearing Range	60-11 DB	87-115 DB	65-111 DB	Trial Mean 95 Control mean 98
Student Average Age	11.9	13.1	11.3	12.0

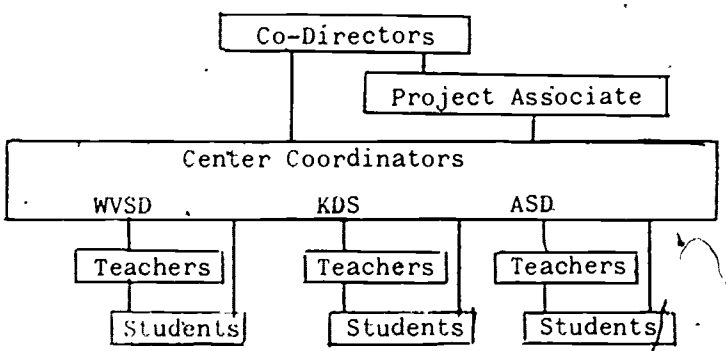


FIGURE 1
SFHI PROJECT ADMINISTRATION

The role of the teacher in the center classroom involved:

1) planning and teaching the SFHI program.

2) providing feedback about implementation of the SFHI program for classes and individuals in the form of regular dicussions with the supervisor and written feedback to the project co-directors.

3) participation in the initial SFHI workshop and an exit debriefing session on program problems and potential.

The role of the center supervisor involved the following areas;

1) student assessment.

2) maintenance of regular evaluation, feedback, and liaison contacts with teachers and the principal of the center school.

3) obtaining feedback from teachers on use of the SFHI program.

4) description and evaluation of the use, effects and results of the SFHI program in classrooms and in the school.

5) regularly contacting and submitting evaluation reports to the project associate or co-directors.

6) provision of help, encouragement, and feedback to teachers in planning and teaching the SFHI program.

The role of the project co-directors and project associate during the trial evaluation included;

1) serving as liaison between centers, providing or communicating materials, equipment, changes and information for use with the SFHI Program.

2) serving as feedback and collection agency for trial evaluation data collected from centers.

3) revision of SFHI program materials as suggested in the variety of forms of feedback from use at all three centers.

SFHI Evaluation Process and Instruments

Evaluation involved assessment of each of the project objectives. This measurement included instruments providing feedback on the products and processes from each phase of the project; program development, program evaluation, and program dissemination. The evaluation process will be described in the following sequence.

I. Final Project Objectives
II. Summary of Evaluation Areas with Cross Reference to Objectives and Data Sources
III. Data Collection Procedures
IV. Data Sources - Instruments
    A. Description
    B. Instruments (Found in Appendix)
    C. Evaluation Activities Time Line Listing
    D. Evaluation Activities Time Line

I. Final Project Objectives

Early in the project the original proposed objectives were regrouped around three major themes to facilitate their evaluation. The categories were,

Student Outcomes,
Curriculum Outcomes, and
Dissemination Outcomes.

The regrouped final project objectives are listed in Table 3.

TABLE 3

Final Project Objectives Evaluated

A. Student Outcomes

To provide an environment which places value upon science and thereby encourages development of skills, interests, and attitudes, and makes science an important part of life and planning for future careers.

To develop a science program that promotes cognitive and language development.

B. Curriculum Outcomes

To adapt an effective and acceptable commercially-available science program, presently used as a regular part of the curriculum in our nation's schools, for use with hearing impaired early adolescents.

C. Dissemination Outcomes

To disseminate the final teacher adaptation guide and support materials to schools for the hearing impaired, interested school systems, and professional organizations.

II. Summary of Evaluation Areas

Each final project objective was assessed using a variety of techniques and involved formative and summative evaluation purposes. Project objective assessment area and data source are cross-referenced in Table 4.

TABLE 4

SUMMARY OF EVALUATION AREAS

Objective	Assessment Area	Data Source
	1. Student Evaluation Profile	
B	Background Information of Students	1.1
A,B	Career Orientation Attitude toward science Interest toward scientific careers	1.2
A,B	Cognitive Development Development of thought processes necessary for success in science	1.3, 1.4
A,B	Language Development	1.5
A,B	Achievement in Science	1.6
B	Background Information of teacher variables	1.7
	2. Formative and Summative Program Development Profile	
B	Lesson Adaptation Report	2.1
B	Cluster Adaptation Report	2.2
B	Student Wrap Up Record	2.3
B	Coordinator's Comments on Specific Lesson Observed	2.4
B	Coordinator Visit Report	2.5
B,C	Interim and Final Coordinator Report	2.6
A,B	Video Tape Records of Sample Classroom Lessons	2.7
	3. Dissemination and Implementation Profile	
C	Curriculum Questionnaire	3.1
C	Implementation Results	3.2

III. Data Collection Procedures

The information assessed for each evaluation area is described in Table 5. This list provides a description of the assessment objectives decided upon early in the project.

TABLE 5

ASSESSMENT OBJECTIVES

1. Student Evaluation Profile

1.1 Assemble background information on all students involved in the trial classes.
1.2 Measure student attitude and interest toward curriculum, teacher, science and careers.
1.3, 1.4 Measure student cognitive developmental level using a Piagetian interview and a paper and pencil inventory to determine appropriateness and for grouping compatibility.
1.5 Measure student achievement in language.
1.6 Measure student achievement in science.

2. Formative and Summative Program Development Profile

To provide information for completion of final edition and overall curriculum evaluation, the following areas were identified;

2.1 Identification of individual lesson usefulness and weak points.
2.2 Identification of lesson sequence, pre-planning, and material problems.
2.3 Measurement of student progress in each cluster.
2.4 Coordinator's description and evaluation of selected lessons to be observed including teacher and student comments.
2.5 Coordinator's description and evaluation of classroom teacher and school situation variables affecting curriculum (setting effects on curriculum).
2.6 Coordinator's description and evaluation of their role, the curriculum adaptation, curriculum usefulness, and changes in setting related to curriculum implementation process (curriculum effects on setting).
2.7 Detailed description of interaction and overall atmosphere in classroom with adapted curriculum in a time sequence during implementation.

3. Dissemination and Implementation Profile

3.1 Questionnaire designed to obtain comments and evaluation statements about the SFHI Program from a sample of teachers, administrators, and state education department personnel directly concerned with teaching and administering hearing impaired programs.
3.2 Listing and description of schools and school systems adopting or planning adoption of the SFHI program.

IV. Data Sources -- Instruments

For each assessment area measuring instruments were found, or developed, to provide valid and reliable information. Table 6 lists project personnel administering instruments, instrument source, subjects assessed, instrument description, and times of instrument administration. A summary of the evaluation process can be found in Figure 2, SFHI Evaluation Activities Time Line, and Table 7, Time Line Listing of SFHI Project Evaluation Activities.

TABLE 6

DATA SOURCES

(Period 1 = April thru August 10, Period 2 = August 11-7, Period 3 = August 18-24, Week 1 = August 25-31, or first week of semester, etc. - see time line.)

1.0 Student Evaluation Profile

1.1 Coordinators completed, for each student involved in trial classes, a Hearing Impaired Student Background Information Profile (Sunal, 1980). This was done during weeks 4-10.

1.2a_1 a_2 Center teachers administered the Science Interest Survey (Sunal, 1980) to students (control and experimental classes) during weeks 1-4 as a pre-test before curriculum was started and during weeks 34-36 as a post-test. Existing standardized tests, such as the Test on Understanding Science (TOUS), could not be used or adapted to this student population. The Survey categories (41 items) include:

1. Science Lessons
2. Science Teacher
3. Science Teaching Method
4. Scientists
5. Science Interest
6. School
7. Scientific Enterprise
8. Science Career
9. Definitions

1.3a_1, a_2 Center coordinators administered Cognitive Developmental Level Interviews during weeks 3-6 and 34-36 as pre and post measurements. Interview tasks included:

1. Sequence of length
2. Classification
3. Conservation of matter
4. Conservation of volume
5. Conceptualization of water level
6. Conservation of weight
7. Displacement of water
8. Proportionality
9. Control of variables
10. Combinatorial reasoning

Results were recorded on a Report Form.

$1.4a_1, a_2$ Center teachers administered a paper and pencil Inventory of Piaget's Developmental Tasks (Furth, 1970) during weeks 3-6 and 34-36 as pre and post measurements. Inventory categories (72 items) included:

1. Conservation of Quantity
2. Transformational Imagery
3. Ordinal Relations
4. Conservation of Weight
5. Classification
6. Combinativity
7. Perspective
8. Kinetic Imagery
9. Conservation of Volume
10. Ordinal Relations
11. Kinetic Imagery
12. Reciprocal Implication
13. Perspective
14. Classification
15. Conservation of Length
16. Verbal Class Inclusion
17. Verbal Transivity
18. Probability

(Validity and reliability reported by Patterson and Milakofsky, 1980)

$1.5a_2$ Center teachers administered and recorded student achievement in language comprehension through use of the Stanford Achievement Test (SAT-HI), (Madden, et. al, 1972).

$1.6a_2$ Center teachers administered and recorded student achievement in science through use of the Stanford Achievement Test (SAT-HI), (Madden et. al, 1972).

2.0 Formative and Summative Program Development Profile

$2.1a_1-a_x$ Center trial teachers completed a Lesson Adaptation Report (Sunal, 1980) after each lesson taught. These were collected on a regular basis by center coordinators.

$2.2b_1-b_x$ Center trial teachers completed a Cluster Adaptation Report (Sunal, 1980) after completion of each chapter taught. These were collected on a regular basis by center coordinators.

$2.3c_1-c_x$ Center teachers administered and recorded student achievement and language development problems on Adapted Curriculum Chapter (cluster) tests throughout implementation period. The Student Wrap Up Report (Sunal, 1980) was used for data collection. Areas included Rate of Success, Reading Problem, other problems.

$2.4d_1-d_q$ Coordinators completed the Coordinators Comments on Specific Lesson Observed During Visit Report (Sunal, 1980) during each visit to center trial classrooms.

$2.5e_1-e_q$ Coordinators completed the Coordinators Visit Report (Sunal, 1980) during each visit to the trial center.

$2.6f_1-f_3$ Coordinators completed the Coordinator Report Form - Interim and Final (Sunal, 1980) during weeks 7, 17, and 34.

$2.7g_1-g_4$ Coordinators video-taped science lessons being taught by the center trial teachers during four periods of the implementation. Tapes were reviewed as to relationship of activities to program instructional mode for formative evaluation purposes.

3.0 Dissemination and Implementation Profile

3.1 The SFHI Feedback Questionnaire (Sunal, 1981) will be mailed out to all recipients of full and sample SFHI program materials during the months following project completion.

3.2 Information from letters, orders of materials, workshops, and other activities were used during the months following project completion.

TABLE 7

TIME LINE LISTING OF SFHI PROJECT EVALUATION ACTIVITIES

September	During the first month of classes (2 visits)
first week of classes	A. Partially complete student form 1, background and pretest 1.1 background 1.2 pre science attitudinal-interest score 1.3 pre cognitive developmental level - interview 1.4 pre cognitive developmental level - inventory 1.5, pre standardized achievement test scores in language and 1.6 science for years 1978, 1979 and 1980
	B. Complete Coordinator Report (2.6)
	C. Complete Video Tape Report 1 (2.7)
	D. Complete Coordinator's Comments on Specific Lesson Observed, and Coordinators Visitation Report (2.4 and 2.5)
	E. Collect forms (2.1-2.3) from center teachers
October	During Second Month of Classes (1 visit)
	A. Complete Video Tape Record 2 (2.7)
	B. Complete Coordinators Comments (2.4) and Coordinators Visitation Report (2.5)
	C. Collect forms (2.1-2.3) from center teachers
November	During Third Month of Classes (1 visit)
	A. Complete Coordinator's Comments (2.4) and Coordinators Visitation Report (2.5)
	B. Collect forms (2.1-2.3) from center teachers

December — During Fourth Month of Classes (1 visit)

A. Complete Coordinator Report (2.6)

B. Complete Coordinator's Comments (2.4) and Coordinators Visitation Report (2.5)

C. Collect forms (2.1-2.3) from center teachers

1981

January — During Fifth Month of Classes (1 visit)

A. Complete Video Tape Record 3 (2.7)

B. Complete Coordinator's Comments (2.4) and Coordinators Visitation Report (2.5)

C. Collect forms (2.1-2.3) from center teachers

February — During Sixth Month of Classes (1 visit)

A. Complete Coordinators Comments (2.4) and Coordinators Visitation Report

B. Collect forms (2.1-2.3) from center teachers

March — During Seventh Month of Classes (1 visit)

A. Complete Video Tape Record 4 (2.7)

B. Complete Coordinators Comments (2.4) and Coordinators Visitation Report (2.5)

C. Collect forms (2.1-2.3) from center teachers

April — During Eighth Month of Classes (1 visit)

A. Complete Coordinator Report (2.6)

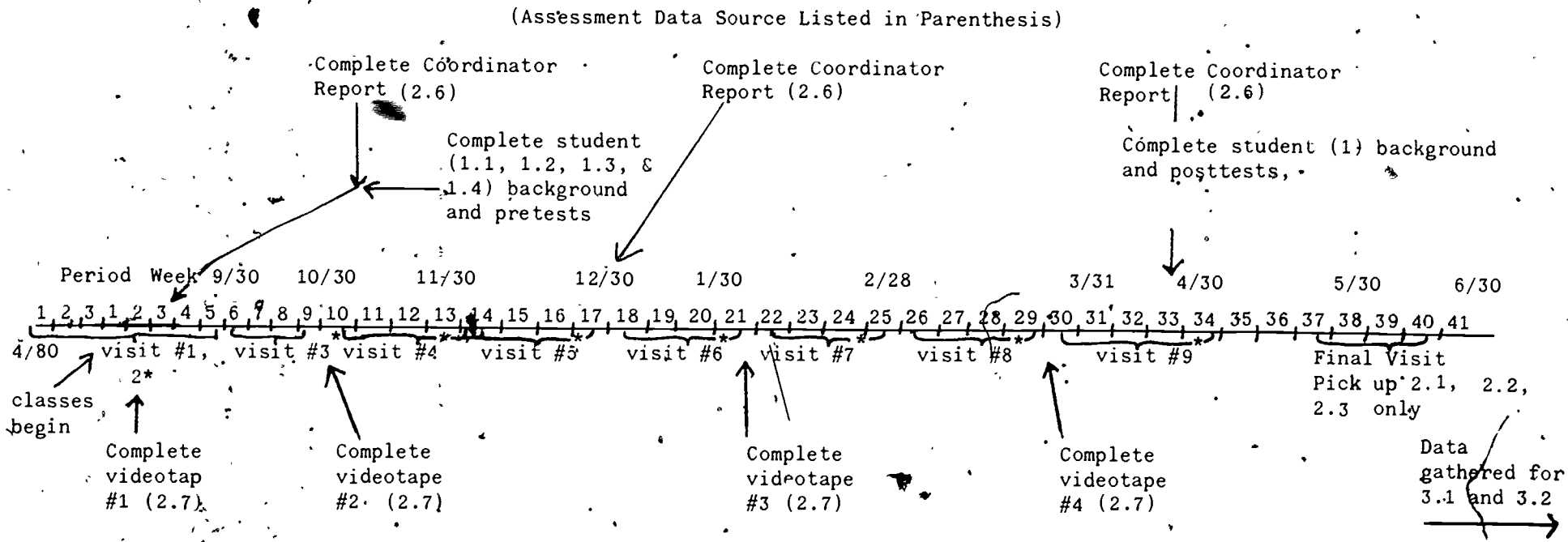
B. Complete Student Profile (1)
1.2 post science interest and attitude score
1.3 post cognitive developmental level - interview
1.4 post cognitive developmental level - inventory
1.5, post standardized achievement test score
1.6

C. Collect forms (2.1-2.3) from center teachers

May-June	During Ninth Month of Classes (1 visit during last week of school)
	Collect forms (2.1-2.3) from center teachers
July - September	Months Following End of Funded Project Activities
	Assemble unsolicited letters, orders and comments received from recipients of project materials
1982	
through May	Send out and collect the SFHI Feedback Questionnaire. This represents a solicited set of comments from recipients or project materials and other professionals in the field.

FIGURE 2

SFHI EVALUATION ACTIVITIES TIME LINE



* Coordinator's comments on specific lesson observed due (2.4) - 9 reports
Coordinator's visitation report due (2.5) - 9 reports
Pick up teacher completed Lesson Adaptation Reports (2.1)
Cluster Adaptation Reports (2.2)
Student Wrap Up Record (2.3)

SFHI PROJECT EVALUATION RESULTS

Student Profile

The student population of 128,000 involved and finally sampled in the SFHI Project included five grade levels in three centers selected from residential hearing impaired schools nationally. The student backgrounds were established by a stratified selection process. Table 8 gives a breakdown of the 135 students selected from the population of early adolescents in the 3 centers, 380 early adolescents.

The SFHI program, or trial, group experienced the SFHI Program in their classrooms during the 1980-81 academic year. The regular program, control, group experienced the science curriculum in regular use in the school.

The total sample of students selected were members of 24 individual class instructional groupings, an average of 5.6 students per class. A total of 61 girls and 74 boys were included. Both the class size and sex ratio are typical for instruction of the hearing impaired.

Student hearing loss ranged from 60 db to 116 db. Hearing loss increased substantially for older students, as shown in Figure 3, reflecting the selective effects of mainstreaming of older children in local schools. Student average age increased as compared to non-hearing impaired children in the various grade levels. The differences are less than one year at third grade to over two years at the seventh grade. Increased hearing loss of those students remaining in the center schools represents a large part of the explanation for this difference.

Community background of these students was almost equally distributed, 45 rural, 44 suburban, and 46 urban. This reflects the location of the schools at the three centers where each serves a different student population.

TABLE 8

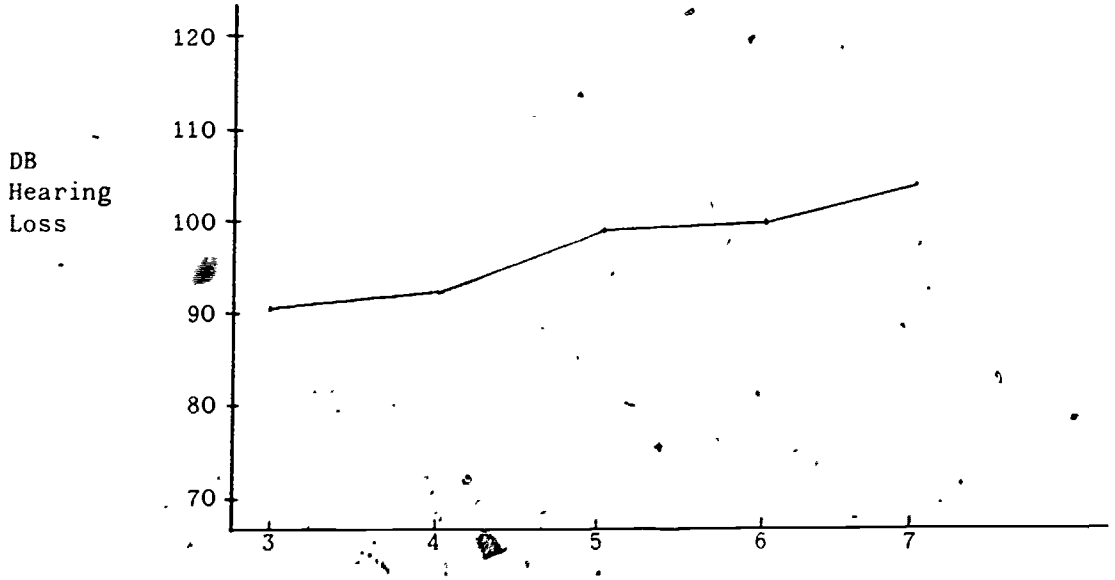
STUDENT BACKGROUND DATA

Area	Grade or Science Program Level of Involvement								
	SFHI Participant					Regular Program Participant			
	3	4	5	6	7	4	5	6	7
Number of Students Involved	28	20	15	17	18	10	10	9	8
Number of Classes	5	4	2	3	2	2	2	2	2
Sex of Student									
Girl	12	9	8	9	9	4	5	2	3
Boy	16	11	7	8	9	6	5	7	5
Student DB Hearing									
Mean	90.9	91.6	99.0	100.2	105.3	89.1	96.3	97.5	101.0
Range	60-110	60-115	70-110	87-111	90-110	60-110	60-112	82-114	85-116
Student Average Age	9.7	11.4	11.4	13.2	14.6	11.5	11.9	12.1	14.5
Home Community Type									
Rural	10	8	2	3	8	5	5	2	2
Suburban	9	4	6	12	4	0	2	3	4
Urban	9	8	7	2	6	5	3	4	2
Parent Hearing Loss									
Both Hearing	24	19	14	14	18	9	10	8	7
One Hearing	0	0	0	2	0	0	0	1	0
Both Deaf	4	1	1	1	2	1	0	0	1

FIGURE 3

HEARING LOSS OF TRIAL STUDENTS

Mean DB Loss by Class Level



Student Outcomes and Instrument Correlations

Four instruments were used to measure variables. Pre and post testing occurred at a time of up to one year apart. The instruments were; Inventory of Piaget's Developmental Tasks, Cognitive Developmental Level Interview Tasks, Stanford Achievement Tests for Hearing Impaired Students, and the Science Interest Survey. The Stanford Achievement Tests for Hearing Impaired Students (SAT-HI) are normally given in May of each year. The three other instruments were administered in Fall 1980, and Spring 1981, 7½ months apart. Statistics used to determine significance of changes, $P \leq .05$ level, involved analysis of variance and post hoc comparisons involving t-tests for three of the instruments and chi-square analysis with changes for the fourth instrument, Cognitive Developmental Level Interview Tasks.

Table 9 gives the mean, standard error and range of the cognitive measures for the trial and regular program students. Two instruments measured cognitive developmental level, Inventory of Piaget's Developmental Tasks (IPDT) and Cognitive Developmental Level Interview Tasks (CDLI). Both groups showed higher post scores than pre test scores on these tasks. The SFHI group differences on both tests showed statistically significant changes occurred. The Regular Program group, given only one test, Cognitive Developmental Level Interviews, did not show a significant difference between the two test periods. The higher pre and post score for the control group may reflect a higher chronological age for this group.

Achievement was measured in two areas, reading comprehension and science using the SAT-HI. Both groups of students showed increases between the 1980-81 test administration. Significant changes were found between pre and post testing with the reading scores for both groups and with the science scores of the SFHI group.

A growth pattern was found over the years on the SAT-HI for both groups in reading and science as shown on Figure 4. The yearly differences between the groups in reading and science were not significant for the years 1978-80. Only the SFHI total group scores were significantly higher in reading and science for the 1980-81 school year, pre and post tests. The 1980-81 SFHI group scores were found to have changed significantly for all levels in science achievement and two levels, 6th and 7th, in reading achievement. These test scores are shown on Figure 5 for each grade level in science and reading achievement.

The growth in science achievement for students at each grade level over three administration times of the SAT-HI is illustrated in Figure 6. Growth averaging one half year, grade equivalent score, was found at each grade level for the 1979-80 school year. Growth averaging one year was found

in science achievement for all grades experiencing the SFHI Program. The SFHI group science scores were found to change significantly for all grade levels during the 1980-81 school year.

Results of the Inventory of Piaget's Developmental Tasks and the Piagetian Interview Tasks for the SFHI trial group are shown on Figures 7 and 8. Pre-post scores are given for each SFHI Program level experienced. Significant changes were found for grade levels 3, 4 and 5 with the IPDT. Changes significant at the .10 level were found for the 6th and 7th grades. Increases of about one or more tasks completed were found with each grade level using the Piagetian Interview Tasks 7½ months apart.

Depressed scores differing from the trend of earlier grade levels were noted for grade 6 during the 1980 pre test scores. See Figures 5, 6, and 7. They were not noted with the Piagetian Interview Tasks in Figure 8. The depression was still evident in the 1981 post test scores with the IDPT results alone. See Figure 7. The backgrounds of grade 6 students appear different from other students used in the trial testing.

TABLE 9

SUMMARY TABLE OF COGNITIVE MEASURE RESULTS

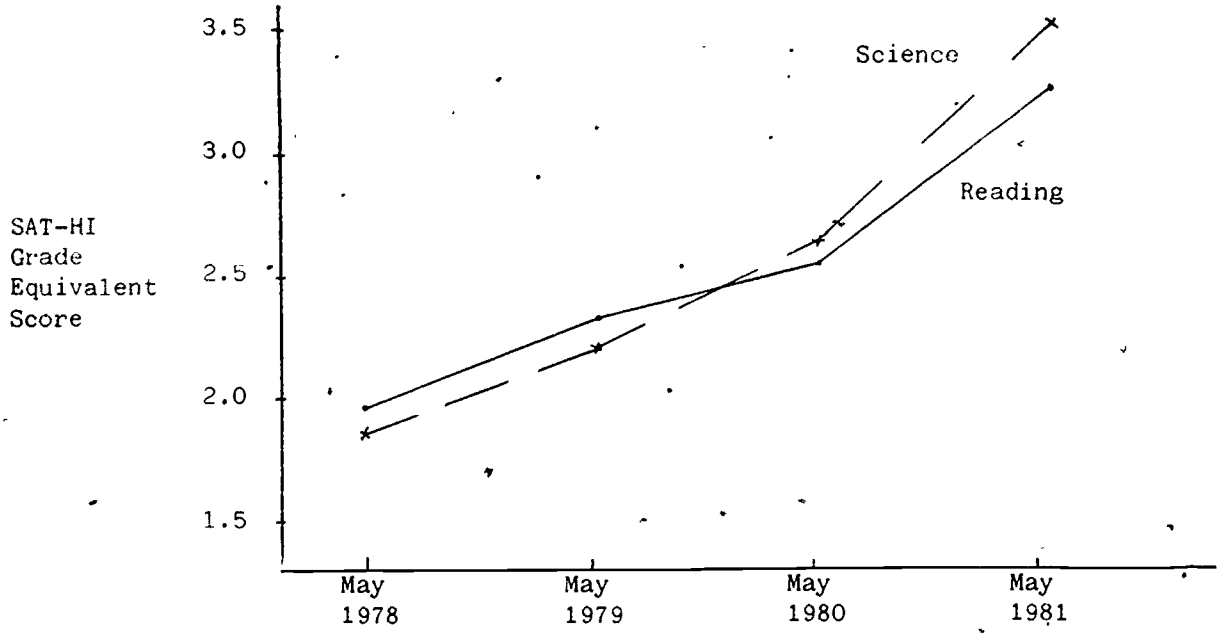
All Grades

	SFHI Trial Participants			Control or Regular Program Participants		
	Mean	Std. Error	Range	Mean	Std. Error	Range
Inventory of Piaget's Developmental Tasks (Furth, 1970)						
Pre trial score	34.70	1.14	16-61			
Post trial score	39.10*	1.24	17-58			
Piagetian Interview Task Score (10 tasks given one point each)						
Pre test score	2.69	(.16)	0-6	3.10	0.50	2-6
Post test score	3.83*	(.20)	0-8	3.20	0.53	2-6
Stanford Achievement Test (SAT-HI)						
Pre trial score						
Reading 1980	2.5	.10	1.2-4.3	2.6	.12	1.2-4.5
Science 1980	2.6	.19	1.0-4.9	2.6	.14	1.1-4.5
Post trial score						
Reading 1981	3.2*	.20	1.8-5.6	2.9*	.13	1.5-4.8
Science 1981	3.5*	.19	1.0-5.8	2.8	.21	1.0-4.1
Past Years						
Reading 1979	2.3	.16	1.3-3.6	2.3	.19	1.2-3.9
Reading 1978	2.0	.29	1.2-3.2	2.0	.28	1.2-3.6
Science 1979	2.2	.18	1.0-4.4	2.3	.14	1.0-3.8
Science 1978	data not complete			data not complete		

*Significantly different from pre trial 1980 score at $p \leq 0.05$ level

FIGURE 4

SUMMARY GRAPH OF ACADEMIC ACHIEVEMENT RESULTS
FOR SFHI GROUP PARTICIPANTS*



*results of Stanford Test Achievement (adapted for HI) Scores given over a 4-year period.

FIGURE 5

SAT-HI RESULTS – PRE AND POST FOR SFHI TRIAL GROUP

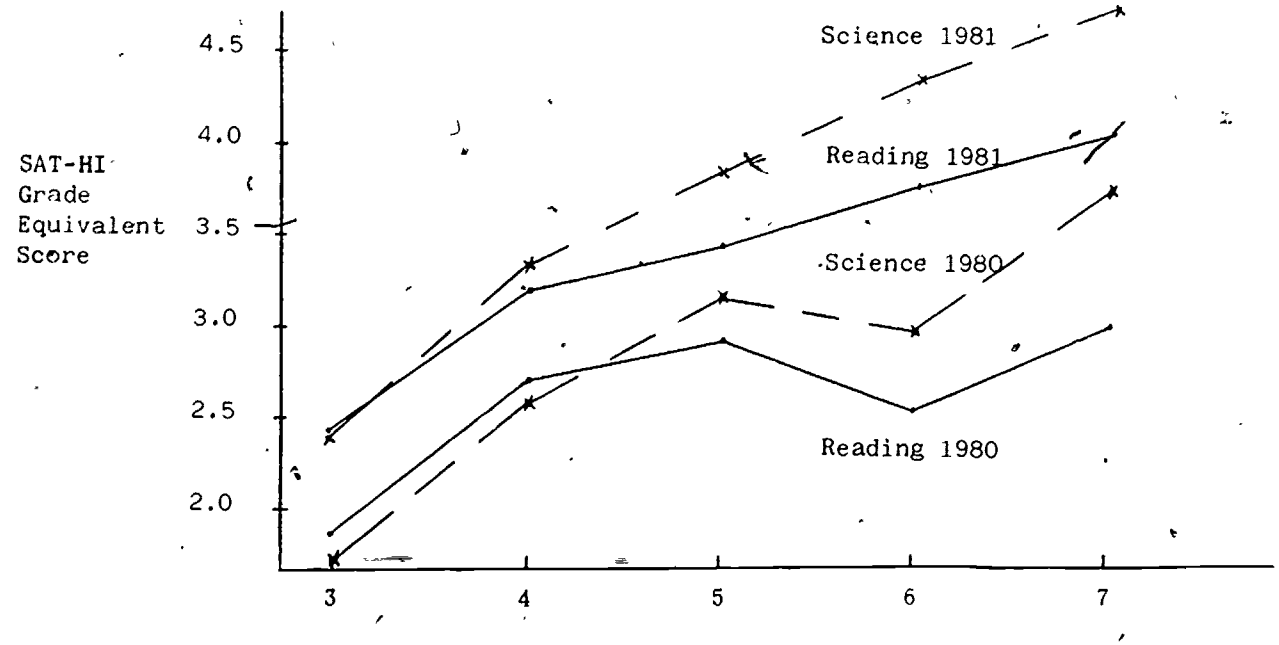


FIGURE 6

SCIENCE SAT-HI GRADE EQUIVALENTS GIVEN FOR SFHI TRIAL GROUP BY GRADE 1978-1981

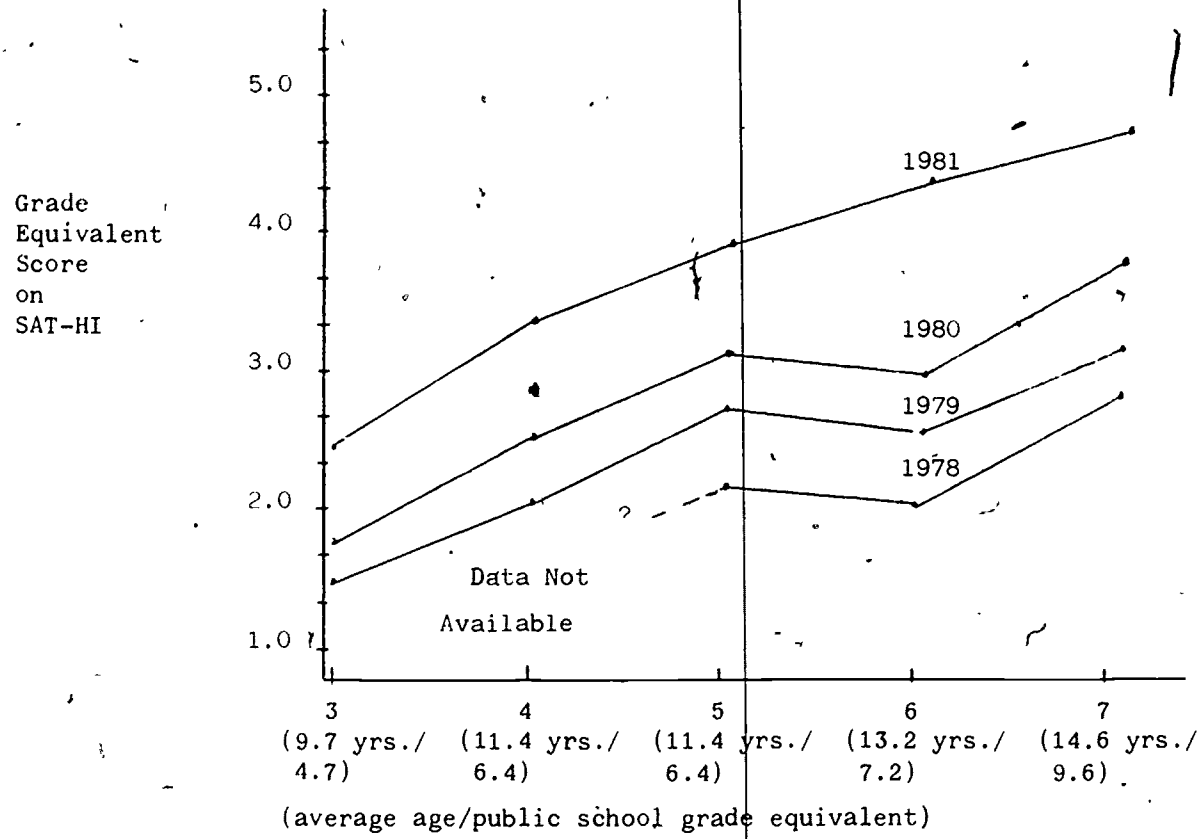


FIGURE 7

INVENTORY OF PIAGET'S DEVELOPMENTAL TASKS - PRE AND POST FOR SFHI GROUP

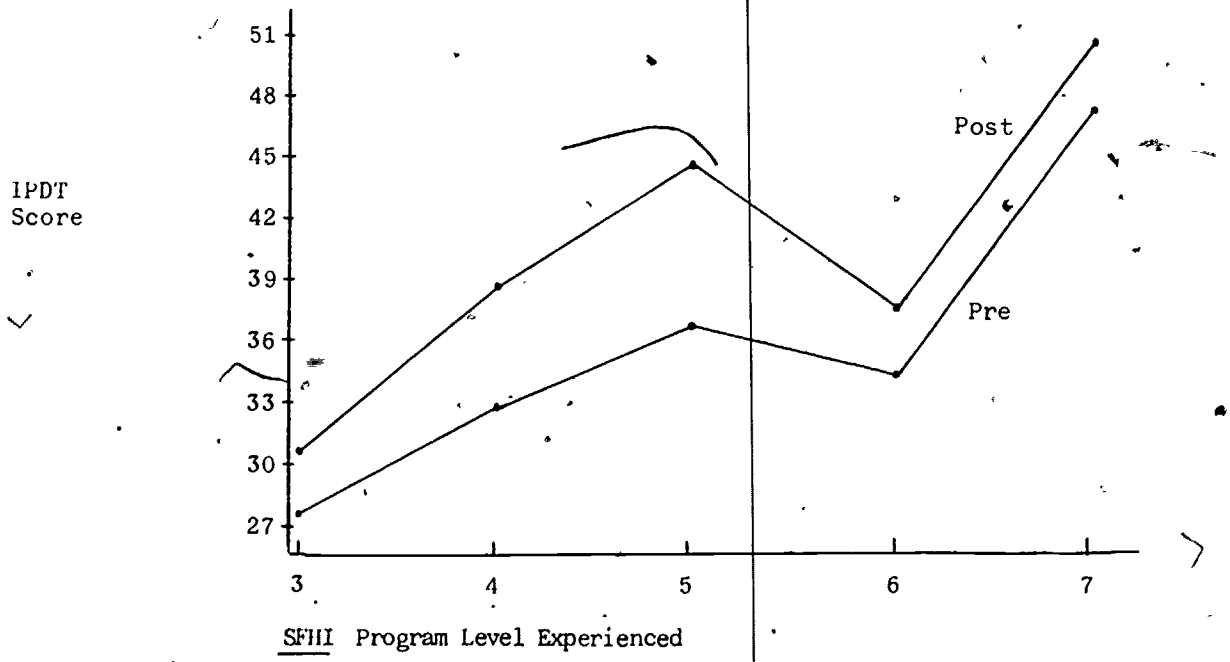
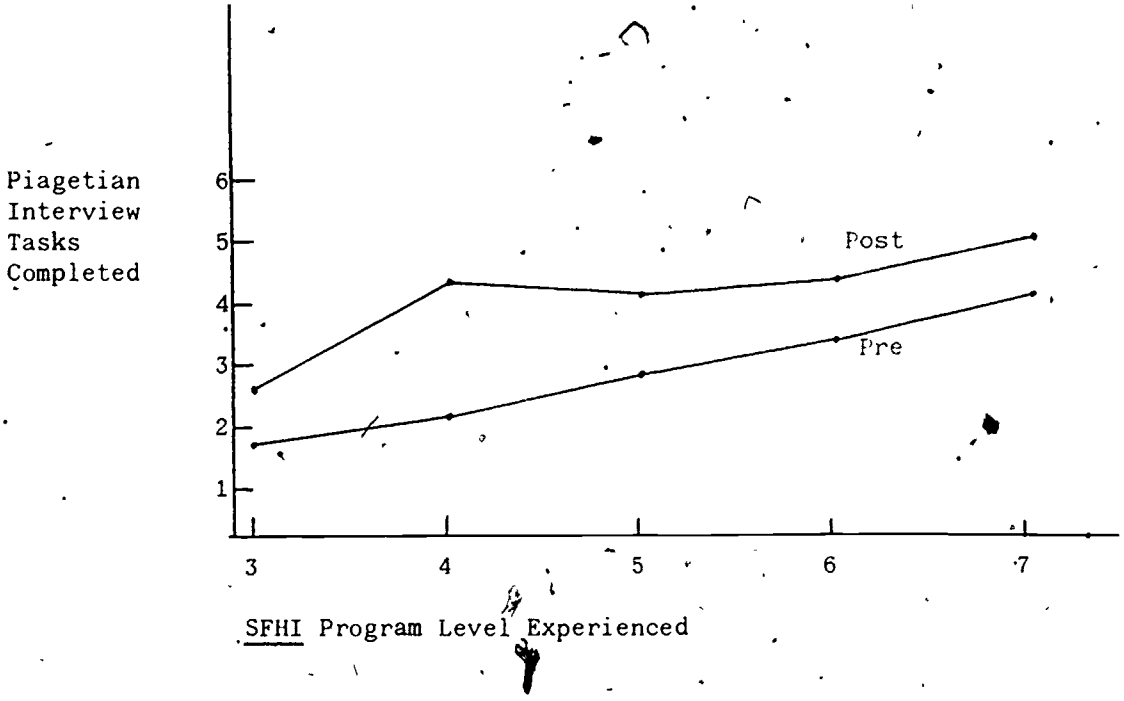


FIGURE 8

PIAGETIAN TASK INTERVIEW - PRE AND POST FOR TRIAL GROUP



Affective results were measured with the Science Interest Survey. The instrument was administered twice, 7½ months apart. A higher score on the Science Interest Survey relates to greater interest or positive feeling toward, and an increased understanding of science, in nine different types of possible social interactions.

Both groups showed small increases in scores during the pre and post tests as indicated on Table 10. Only the SFHI group resulted in a significant increase in score, about five percent.

Breaking down the test into part scores gives information relating to the sources of affective change. Four areas, also shown in Table 11, were found to have significantly increased during the SFHI trial program. They were, more positive feeling for the teacher in the science classroom, greater interest in science as a discipline and as a hobby, more positive interest in school and school activities in general, and greater interest in science as a

possible career choice. These areas appear to be the most probable areas for change as they relate in a practical sense to the SFHI program activities. The curriculum does not relate directly to other categories addressed in the survey.

Results of the Science Interest Survey for each grade level experienced by the trial group are shown in Figure 9. Increases were found at every grade level. Significant increases were found at the fourth, fifth, and sixth grades only.

TABLE 10

SUMMARY TABLE OF AFFECTIVE MEASURE RESULTS

All Grades

	SFHI Trial Participants			Control or Regular Program Participants		
	Mean	Std. Error	Range	Mean	Std. Error	Range
Science Interest Survey						
Pre trial score	89.40	1.21	66-109	90.05	1.89	63-112
Post trial score	93.58*	1.12	80-115	90.58	1.97	62-114

*significantly different from the pre trial score at $p \leq .05$ level using analysis of variance statistics.

FIGURE 9

SCIENCE INTEREST SURVEY SCORES - PRE AND POST FOR TRIAL GROUP

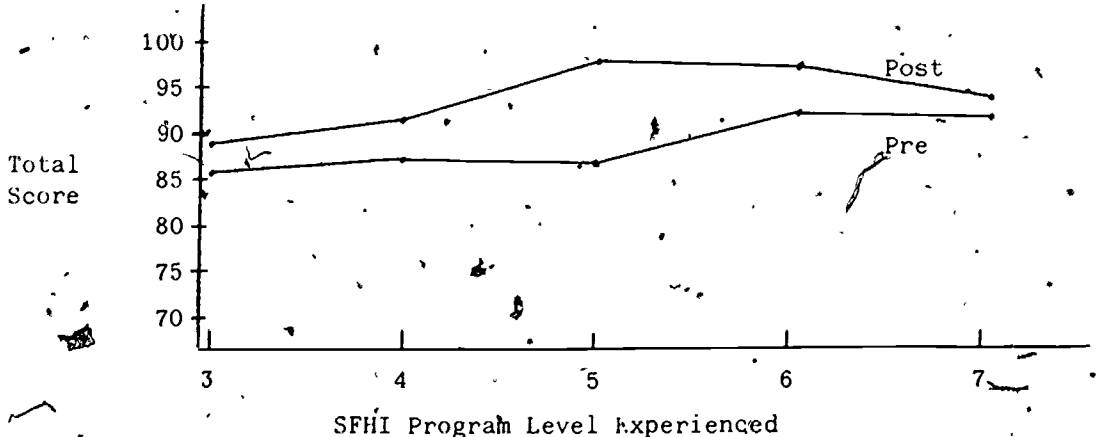


TABLE 11

SUMMARY TABLE OF PART SCORES FROM THE SCIENCE INTEREST INVENTORY FOR THE SFHI TRIAL GROUP

(High score indicated greater interest or positive feeling toward)	Mean	Standard Error
Science Lesson	8.29	0.28
	8.68	0.21
Science Teacher	9.54	0.35
	10.60*	0.20
Science Teaching Method	11.54	0.29
	11.21	0.23
Scientists	11.25	0.23
	11.73	0.26
Science Interest	15.08	0.32
	15.83*	0.37
School	11.60	0.32
	12.35*	0.30
Scientific Enterprise	6.66	0.14
	6.63	0.15
Science Career	9.08	0.30
	9.90*	0.32
Definitions (not an interest category but relates to understanding of key ideas in survey)	6.74	0.16
	6.89	0.20

*significantly different from pre trial score at $p \leq 0.05$ level using t-test statistics.

Correlation of the major study instruments was performed to determine their possible use as predictors in needs assessment, grouping for placement at the appropriate SFHI program level, and potential success factor relationships. Table 12 displays the correlation coefficients relating four of the project assessment instruments for the trial students. The instruments were found to be moderately to highly correlated with each other on pre to post administrations; for IPDT $r = 0.84$, Tasks (CDLI) $r = 0.70$, Science Interest Survey $r = 0.62$,

SAT-HI Reading r = 0.77, and SAT-HI Science r = 0.55, Lower pre-post SAT-HI Science correlation, 0.55, may reflect program treatment effects. SAT-HI Reading and SAT-HI Science correlations for 1981 were r = 0.83, 1980 r = 0.55 and 1979 r = 0.50. Many more high reading achievers are now also high science achievers in 1981 as compared to other years. Insignificant correlations of hearing loss or home community type, not reported on Table 12, provide evidence for the success of the program with students of differing needs and backgrounds.

Of the two measures of developmental level, the Inventory of Piaget's Developmental Tasks was found to be more highly correlated with higher reading and science achievement and higher science interest. The lack of correlation of the Cognitive Developmental Level Interview Task score and science interest, in addition to lower correlation with achievement scores may reflect the fact that the instrument measures a different component of a student's developmental level. About on-half of the interview tasks were designed to measure formal thought level, while all of the IPDT measure focused on the concrete thought level. For at least this reason the CDLI Tasks may not predict performance in an activity based science program although it still remains an important measure of the SFHI program goals. A second factor, leading to lowered CDLI Task predictability is the more discontinuous nature of the scoring within and between the interview tasks. The IDPT is recommended for helping teachers to group students on appropriate levels for use of the SFHI Program. Scores approximating those on Figure 7 could be used as guidelines for placement on specific program levels.

Results of the Science Interest Survey correlation also reveal program interactions. Small, or no, correlation is noted between pre interest scores and achievement and cognitive development. Higher student achievement or intellectual development did not relate to higher student interest or positive feelings toward science. Post interest scores indicate moderate and significant

correlation values. If the interest scores are valid indications of student's feelings, the SFHI curriculum treatment may have caused a restructuring of (or at least a greater familiarity with science) the student's science understanding to significantly relate high interest with high achievement (SAT-HI) and higher intellectual development level (IPDT). In actual fact, some, although small as reported on Tables 8 and 9, restructuring of the student's affective system also occurred.

TABLE 12

CORRELATION OF MAJOR PROGRAM EVALUATION INSTRUMENTS

Instrument	Inventory of Piaget's Developmental Tasks (IPDT)		Cognitive Developmental Level Interview Tasks (CDLI)		Science Interest Survey		DB Hearing Loss
	Pre	Post	Pre	Post	Pre	Post	
Science Interest Survey							
Pre	.19	.05	.22	-.09	-	.62*	-.03
Post	.21	.30*	.20	.06	.62*	-	.03
SAT-HI							
Reading							
Pre	.38*	.45*	.22	.44*	.03	.03	.11
Post	.58*	.54*	.24*	.39*	.32*	.26*	.10
Science							
Pre	.48*	.59*	.44*	.47*	.20	.29*	.25*
Post	.67*	.69*	.43*	.57*	.29*	.38*	-.03
IPDT							
Post	.84*	-	.58*	.64*	.05	.30*	.09
CDLI							
Post	.54*	.64*	.70*	-	-.09	.06	-.02

*Significant at P≤.01 level

Formative and Summative Program Adaptation Results

Program results have been reported using data sources 1.1 through 1.6, see Table 6, of the Student Evaluation profile. Other sources dealing with data from teachers, students and lessons taught, sources 2.1 to 2.7 on Table 6, were used in formative evaluation and resulted in program development changes and redesign in the SFHI experimental text editions. These reports finally led to changes in the SFHI final text edition in seven basic areas.

1. Reorganization of objectives, lessons, and content within lessons.
2. Deletions and additions to paraphrasing statements.
3. Deletions and additions to identification of key words and phrases for videotaping.
4. Deletions and additions to uses of identification cards.
5. Deletions and additions to uses of language cards.
6. Changes made in lesson evaluations.
7. Changes in equipment and materials.

Data sources dealing with the Formative and Summative Curriculum Adaptation Profile sections 2.4 to 2.6 on Table 6 provided narrative descriptions of the outcomes of the program. Following in Table 13 is a summary of narrative for all centers giving a representative sample of statements from the three project coordinators who worked directly with the teachers and students. Order is not significant of emphasis or time spent.

Summarizing the results of sections 2.4 to 2.6 on Table 6 leads to and evolving set of observations and statements. Mixed feelings, although some very positive, were observed at first. Later changes became evident in the physical environment of the classrooms, teachers, and students. This

change was characterized by more excitement, more "things" (living and non-living) in the classroom, positive feelings toward learning and science, more effective learning, and more time for the teacher to concentrate on individuals rather than on lesson planning or implementation.

Near the end of the school year the effects of the SFHI Program remained similar to that of mid-year. Teachers and students judged the curriculum as very effective overall, interesting, and something they would like to experience again. Teachers reported the program as better than other science programs because it was

1. more complete,
2. more experience-oriented,
3. had good in-class and home activities,
4. less work than developing their own or using a text-oriented program,
5. was clearer for the teacher, and
6. was already adapted to students' needs.

Many changes found in SFHI are being carried out by the teachers in teaching their regular science program. This was being done at much expense to teacher time and student learning each year. These changes have been completed in SFHI. Additional changes should be made to the SFHI Program to meet individual class and student needs. Usually these were not possible because of more basic and major changes teachers needed to make in working with their regular science programs.

Additional changes not generally made, but found in the SFHI Program, were judged by the teacher as very effective. One was the use of a standardized approach to science sign language between teachers and across grades. A complete system of lesson notes, sign indices, and video tapes exist for each lesson set in SFHI. Another was the use of a sequence to plan and teach lessons

which stressed activity and experiences first, followed by interpreting experience results and applying the results in a variety of situations. Teachers and students judged this procedure as very effective when compared with the process of explanation followed by practice found in the teachers' regular science programs.

TABLE 13

COORDINATOR REPORT FORM - SAMPLE STATEMENTS

INTERIM AND FINAL

COORDINATOR _____ TEACHERS OBSERVED _____

DATE _____ GRADE LEVELS _____

(3 required Sept., Dec., April)

Use additional space if needed for response - staple all pages.

1. Describe role of coordinator to date.

September	1. observation of classes 2. testing students and collecting student data	3. videotaping of classes 4. resource person
December	1. observation of classes 2. testing students and collecting teacher feedback sheets and student data	3. resource person 4. videotaping of classes
April	1. observation of data 2. testing students and collecting teacher feedback sheets	3. resource person 4. videotaping of classes

2. Evaluation of center activities and curriculum to date.

September	1. Class activities slow to start 2. Rooms fairly sterile environments 3. Teachers have little background in science education, few enthusiastic about teaching science. 4. Groups actively using materials

December
1. Classes have performed SFHI activities without major problems
2. difficulty in implementing some lessons - more or continued inservice would help
3. A marked improvement is obvious in classroom physical environment. Classes are now exciting, students involved.
4. Other teachers have shown interest and enthusiasm in curriculum. They have attempted interdisciplinary approach reinforcing signs and introducing metrics.

April
1. No significant problems with curriculum in school.
2. Teachers are following curriculum, making changes for individuals when necessary, and asking more questions.
3. Classes are exciting, students are involved.
4. Teachers have expressed interest in taking science methods courses and are interested in carrying out curriculum next year.

3. Relation with staff of school

September
1. No problems
2. Fairly smooth relationships

December
1. Good rapport with teachers, feel welcomed
2. Interest and enthusiasm for program has remained high

April
1. No problems
2. More questions asked, good relationship

4. Teachers' attitude and judgements
a. Overall judgement of effectiveness of curriculum to date

September
1. Some difficulty
2. Too early to tell, teachers feel it is effective

December
1. Teachers feel SFHI generally effective, children benefitting cognitively and affectively.
2. Fair, teachers still have difficulty letting the children do the work.
3. Very effective, some changes needed - visuals, simplify steps.

April
1. Very effective overall

b. Has using this curriculum changed their attitude toward teaching science?

September
1. No
2. Excited about new approach

December
1. Yes, more enthusiastic and activity oriented in teaching
2. Becoming more excited about the potential of the curriculum

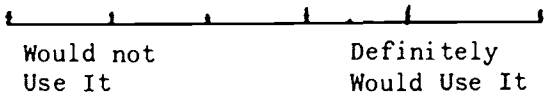
April
1. Attitudes have remained similar to mid year.

c. Has using this curriculum changed their emphasis on student goals in science teaching? If so, how?

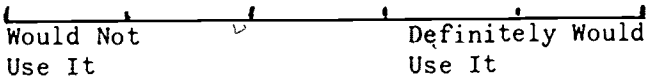
September	1. Not as yet 2. Teachers in the past have been concerned
December	1. Made goals more student action oriented
April	1. Becoming more student oriented

d. Would they be interested in using this curriculum in the future?

September	1. Too early to tell 2. Definitely would use it
December	1. Definitely would use it
April	1. Definitely would use it



e. How would they perceive other science teachers of the hearing impaired reacting to this curriculum?



Why?

September	1. Too early to tell
December	1. Definitely would use it if they felt comfortable with activity based approach
April	1. Very helpful in planning and organizing, definitely would use it

f. How does this curriculum compare with other curricula they have used in the past?
In what ways are other curricula different?

September	1. Did not have curricula to work from 2. Too early to tell
December	1. This one is more complete, teacher is not required to develop basic materials, pull from other sources 2. It is more experience oriented 3. Good homework activities possible 4. Students are working at or just under materials designed for their age. Previously materials used had to be two to four years under student age.
April	1. Much better, clearer and already adapted to students needs 2. Much different, emphasis on involvement through activities

g. Overall judgement of effectiveness of this curriculum adaptation in helping these teachers to teach science with the hearing impaired

September
1. Too early to tell

December
1. Highly effective
2. It will definitely improve teacher effectiveness
3. Has helped them by making them ask more questions

April
1. Effective improvements can be made in more homework review, breaking lessons down
2. For the first time, students are working at/near grade level materials.

h. 1) List some areas of adaptation of curricula these teachers regularly make that are found in this adaptation.

Reading and vocabulary level
Identifying vocabulary for special work, language cards, I.D. cards
Use of experiments/examples
Make more visually and experience oriented
De-emphasis on language - understand language to understand material not necessary
Activity-oriented learning

2) List some areas of adaptation of curricula these teachers regularly make that are not found in this adaptation

Captioned movies not included

3) List some needed areas of adaptation of curricula these teachers do not regulary make that are found in this adaptation.

Standardized approach to sign language
Use of a sequence to plan and teach lessons - learning style

Dissemination, Implementation, and Follow-up Activity Results

The remaining data sources from which information was obtained was the Dissemination and Implementation Profile, sections 3.1 and 3.2 on Table 6. At this time little information is available from the SFHI Feedback Questionnaire, section 3.1. Mailing of the questinnaires is not complete. A supplemental report should be available by December, 1982 on this section.

Full sets and sample copies have been sent to about 450 individuals and settings. These include schools for the hearing-impaired, individually identified teachers who have shown interest in using the SFHI program, state

department offices dealing with science education or education of the deaf, school districts and schools identified as having an interest in using the SFHI Program, clearinghouses and associations relating to program goals (e.g., ERIC), and individuals and professionals who have been identified as having an interest in using the SFHI Program. The majority of copies have been sent to schools and state education departments.

Data sources, 3.2 on Table 6, involving letters, orders, workshops, and other activities have been encouraging at this early date. Use of the SFHI program beginning in the fall of 1981 is occurring in 5 locations, West Virginia, Missouri, Arkansas, Florida, and Washington, D.C. This program adoption and implementation took place before most of the SFHI program guides were mailed and before any announcement of its availability in journals or other reports. Letters to date have been positive to strongly positive. Sample statements in communications include:

> The materials are one of the few examples I have found specifically adopting a basal text to the needs of the hearing impaired.
>
> I would like to include the SFHI materials in the workshop.
>
> Wow! What a great thing you have done!
>
> I have always used the Houghton Mifflin program and think highly of it. However, the series always needs adaptation for the hearing impaired student and doing that was a painstaking, tedious process. Your new series seems to take care of the problem and looks like a real winner.
>
> For too long, science has not been a part of the hearing impaired student's curriculum because of the amount of preparation and scaling down of the material that was necessary. Hopefully, now, that will change.
>
> Many of the adaptations listed in SFHI are already in use by our teachers. I found many more that we had not included yet. The ideas appear to be very helpful.
>
> The use of taping for providing signs for science terms would be an asset to any program.

SFHI workshops have been scheduled in 3 settings and inquiries have been made about others. Two workshops have been completed in the fall of 1981. A workshop outline of activities carried out can be found in the book Science for the Hearing Impaired -- Introduction to the Program.

A number of presentations, to date, have occurred at meetings of national and local organizations. For example, in 1981 an information presentation and a workshop have been presented at the annual meeting of the National Science Teachers Association and the Association of Educators of Teachers of Science in New York City. A workshop has been presented at the annual state meeting of the West Virginia Council for Exceptional Children. Additional presentations are scheduled or planned.

Future on-going activities will involve:

1. Monitoring the use, problems and potential revisions of the SFHI Program materials.
2. Continued distribution of SFHI program components.
3. Provision of workshops for schools planning adoption or implementation of the SFHI program.
4. Presentations at professional conferences on the nature and results of the program.
5. Media exposure on the local and national level in journals, newspapers, and radio.

SFHI PROJECT SUMMARY AND COMPLETION

Regardless of the type or source of the school science curriculum, teachers for the hearing impaired are consistently faced with decisions regarding the selection, development, and modification of effective science materials. At the present time, at least six problem areas were found associated with the use of traditional science programs with hearing impaired youth. They were:

1. Emphasis of facts and memorization vs. skills and science processes
2. Activity with known results vs. discovery and unknown results.
3. Amount of reading material vs. active participation in meaningful activities.
4. Appropriate material adapted for the hearing impaired student .
5. Difficult terminology.
6. Advanced concept level (Sunal and Burch, 1982).

This project attempted to address these problem areas in developing an effective science program and at the same time establish a model for curriculum development for hearing impaired youth.

In planning Science for the Hearing Impaired, the authors had specific goals in mind;

1. To produce and disseminate an adaptation of an effective and acceptable commercially-available science program, used as a regular part of the curriculum in our nation's schools, for use with middle childhood hearing-impaired students.

2. To develop a science program that promotes a classroom environment which places value upon science, encourages development of skills, interests, and attitudes and makes science an important part of life and planning for future careers.

3. To develop a science program that promotes cognitive and langauge development.

The developmental process began with available literature and school science programs in addition to the experiences of a number of curriculum developers, teachers of the hearing impaired and science teachers. The first step involved an analysis of existing science programs used and available to schools with hearing impaired students in the United States. The

results and analysis instrument; Curriculum Analysis Guidelines (Sunal and Burch, 1982), led to the criteria used in the final selection process. This process concluded that two programs published by the Houghton Mifflin Company provided the most effective base program and greatest potential for adaptation for hearing impaired/language delayed youth. The programs are entitled Science and Spaceship Earth.

The development continued with writing, pilot field testing and rewriting of program materials and sequence. The project time line for development of Science for the Hearing Impaired is shown below.

DEVELOPMENT

May 1980	Complete analysis of science programs Planning conference
Summer 1980	Writing and adapting materials for experimental SFHI Program Regional pretesting of sample program components
Academic Year 1980-1981	National field testing of experimental SFHI program
Spring 1981	Analysis of field test results and program revision
Summer 1981	Preparation of final edition of the SFHI program

DISSEMINATION

April 1981	Adaptation model presented and SFHI program workshop given at National Science Teachers Association Conference
Summer and Fall 1981	Distribution of sample and full SFHI program sets, levels 3-7
Academic Year 1981-1982	Notification, description, and workshops involving SFHI program given in journals, at conferences, and in school systems
	Continued distribution of sample and full SFHI program sets

The project activities resulted in a science program designed especially to meet the unique needs of a hearing impaired and deaf population. This is the first program developed and tested on the national level to address the special needs of the early adolescent hearing impaired student, ages 9-13. Results of field testing of a national sample drawn from urban, suburban, and rural settings indicate SFHI is effective with hearing impaired early adolescent students. Comparison with students who remained in regular science programs and to previous student progress show significant educational progress and advantages in both the cognitive and affective areas for those students involved with the SFHI program. SFHI program participants showed statistically and educationally significant gains in cognitive development, achievement in science and reading comprehension, and in certain relevant areas of interest and attitudes. Higher interest and more positive feelings were found at the end of the program toward their science teachers, interest in science as a discipline or hobby, school and school activities, and science careers.

Trial testing reported results showing that the SFHI program is acceptable to teachers, students, and schools. It was reported as consistently more highly effective, contained most of the adaptations needed for hearing impaired students, had added features valuable for helping teachers to individualize, was more complete and was more likely to be used than the regular science programs in use in these or other schools. The SFHI program was not simplified or lowered to meet student needs but adapted so that accepted science education goals in our nation's schools could be attained by hearing impaired youth.

Thus, the end of the project is evidenced by an effective and acceptable science program for the early adolescent hearing impaired student containing the following components:

Texts and Materials

Introduction to the Program
Science for the Hearing Impaired Teacher's Guide Level 3
Science for the Hearing Impaired Teacher's Guide Level 4
Science for the Hearing Impaired Teacher's Guide Level 5
Science for the Hearing Impaired Teacher's Guide Level 6
Science for the Hearing Impaired Teacher's Guide Level 7
Vocabulary and Language Videotapes (5 sets, one for each SFHI level)
Media Material Guide to Accompany Use of SFHI Levels 3-7
Final Report: Adapting Science Curricula for Hearing Impaired Early Adolescents - Project Summary, Results and Conclusions

Dissemination System

Continued mailing of SFHI materials to interested individuals
Workshops available for schools planning to adopt or implement the SFHI program
Presentations at professional conferences on nature and results of the program
Media exposure on the local and national level - journals, newspapers, and radio

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_____ "Student Wrap Up Record Report".

_____ "Lesson Adaptation Report".

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_____ "Coordinator's Visitation Report".

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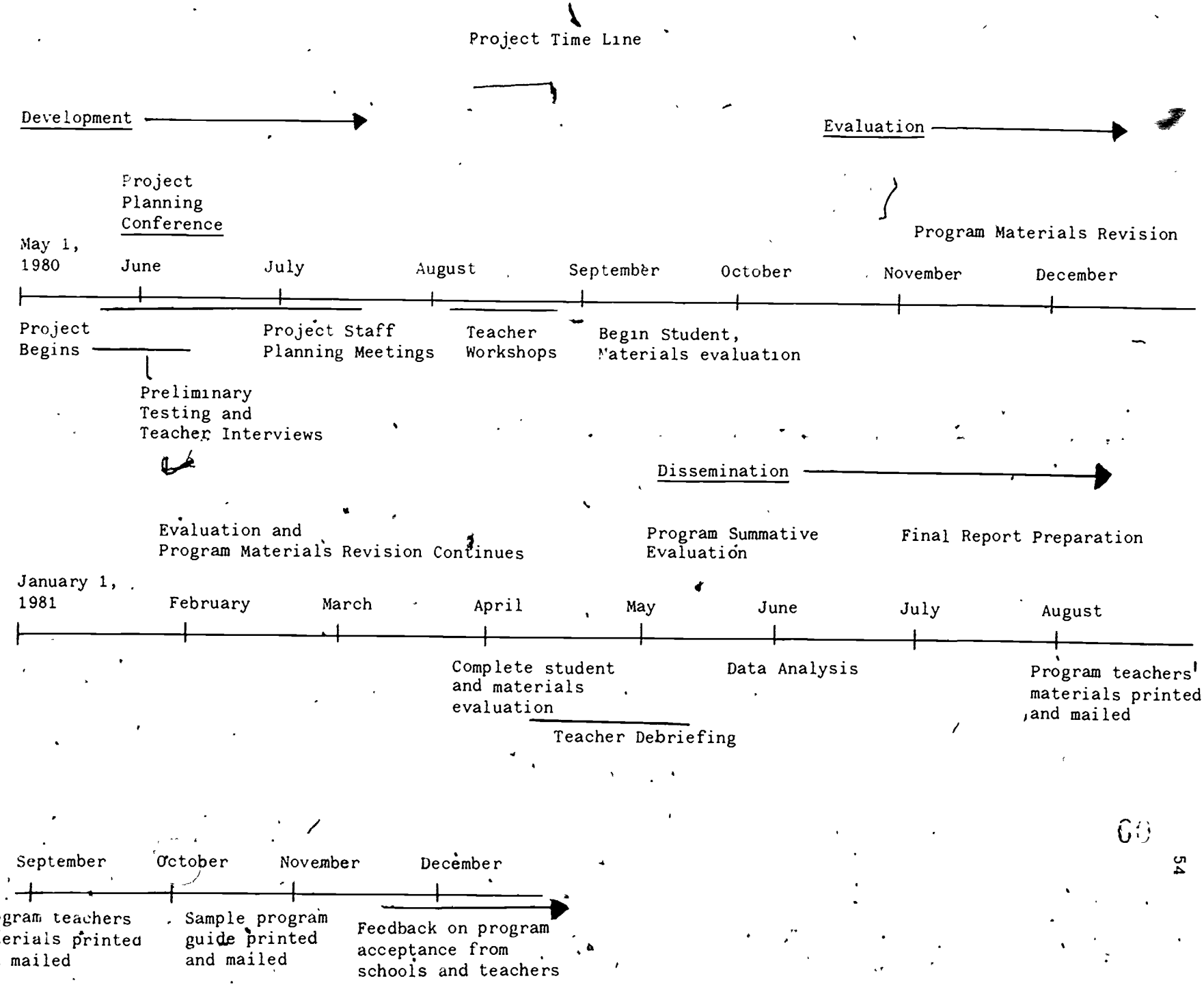
APPENDIX A

PROJECT ACTIVITIES

1. Sequence of Project Activities
2. Project Time Line


Project Time Line
Development
Evaluation
Project Planning Conference
Program Materials Revision
May 1, 1980
June
July
August
September
October
November
December
Project Begins
Project Staff Planning Meetings
Teacher Workshops
Begin Student, Materials evaluation
Preliminary Testing and Teacher Interviews
Dissemination
Evaluation and Program Materials Revision Continues
Program Summative Evaluation
Final Report Preparation
January 1, 1981
February
March
April
May
June
July
August
Complete student and materials evaluation
Data Analysis
Program teachers' materials printed and mailed
Teacher Debriefing
September
October
November
December
Program teachers materials printed and mailed
Sample program guide printed and mailed
Feedback on program acceptance from schools and teachers

SEQUENCE OF PROJECT ACTIVITIES

Development

May 1980	Complete analysis of science programs Planning conference
Summer 1980	Writing and adapting materials for experimental SFHI program Regional pretesting of sample program components
Academic Year 1980-1981	National field testing of experimental SFHI program
Spring 1981	Analysis of field test results and program revision
Summer 1981	Preparation of final edition of the SFHI program

Dissemination

April 1981	Adaptation model presented and SFHI program workshop given at National Science Teachers Association Conference
Summer and Fall 1981	Distribution of sample and full SFHI program sets, levels 3 7
Academic Year 1981-1982	Notification, description, and workshops involving SFHI program given in journals, at conferences, and in school systems Continued distribution of sample and full SFHI program sets

APPENDIX B

PROJECT STAFF

PROJECT STAFF

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Morgantown, WV 26506

John DeMary, Project Assistant
Loudon County Schools
Loudon, VA

Appendix C

TRIAL CENTERS USING THE SCIENCE FOR
THE HEARING IMPAIRED PROGRAM

1. Kendall Demonstration Elementary School
2. West Virginia Schools for the Deaf and Blind
3. Arkansas School for the Deaf

KENDALL DEMONSTRATION ELEMENTARY SCHOOL
Gallaudet College, Washington, DC 20002

Dean - Mike Denninger
Principal -

Center teacher	Levels
Carol Guerrero	4th and 6th

SFHI Field Supervisor - Angela Bednarczyk

General Description of Center

Kendall traces its roots back 122 years to 1857, when Amos Kendall opened a school for deaf and blind children from the District of Columbia on two acres of his estate in northeast Washington, DC. Over the years, Kendall has grown and developed. In 1970, legislation passed by Congress transformed Kendall into the Kendall Demonstration Elementary School.

It was that legislation which paved the way for a major growth in Kendall's goals and programs and facilities. The new KDES facility will accommodate up to 300 pupils, offering both structured and open learning spaces and the latest in educational technology. Kendall is charged not only with providing quality education for hearing impaired children in the metropolitan Washington area, but also with developing and evaluating educational materials, methods, and programs for use in other schools for hearing impaired children across the nation.

KDES serves children from infancy through age 15. Its program provides for a variety of students and their special needs. The school receiyes its financial support through the Department of Health, Education, and Welfare and is a part of the Pre-College Division of Gallaudet College, the only accredited liberal arts college for deaf students in the world.

Kendall Facility and Program

The school's barrier-free environment features instructional areas designed for ease of supervision and observation. The acoustics and interior design were carefully planned to meet the needs of hearing impaired youngsters. The school features special instruction rooms, staff work stations, learning centers, a mini-auditorium, large dining room and gym, a greenhouse, television studio, and a demonstration home in the Preschool area. Also, 18 residential apartments will be available for families of children undergoing extensive educational diagnostic services.

Kendall operates a 12-month program with short vacation breaks scheduled throughout the school year. Classes begin in September and end late in July or early in August. The summer program, usually four weeks in length, is the culmination of the school year.

The educational program revolves around the basic core of language arts,

which includes reading, writing, spelling, and English, social studies, science, and mathematics. In addition, the children take physical education, home economics, and art. Pre-adolescent youth in the Middle School Department have additional work in areas such as sex education, drama, counseling, tutoring, etc. All subjects are offered using the appropriate total communication strategy - speech, audition, sign language media, reading, writing, mime, etc. - as important parts of their learning experience. Visitors are able to observe instruction without disturbing classes from ramps, platforms, hall space, and numerous observation rooms with one-way mirrors and closed circuit television.

Weekly visits to the library, computerized instructional systems, field trips in and around the nation's capital, all serve to complement classroom studies. Available support services meet the physical, social, and emotional needs of students and their families.

WEST VRIGINIA SCHOOLS FOR THE DEAF AND BLIND
Romney, West Virginia 26757

Superintendent - Jack W. Brady

Elementary School for the Deaf
Principal - Virginia L. Pancake

Junior-Senior High School for the Deaf
Principal - David West

Center Teachers	Levels
Sue Heidecker	3rd
Ann Staub	3rd and 4th
Margaret Ceder	7th
Mike Johnson	5th and 6th

SFHI Field Supervisor - Mary S. Paul

General Description of Center

The West Virginia Schools for the Deaf and the Blind were established in Romney, WV in 1870. Romney is in the Eastern Panhandle of West Virginia. The Schools constitute a part of the State Public School System for the education of those students of suitable age and mental capacity who, because of their handicap, cannot profit from attending the regular public schools. Any eligible student with sufficient vision or hearing handicap will be accepted from any part of the state as long as there is available space in the dormitories and classrooms.

The West Virginia Schools for the Deaf and the Blind consist of the School for the Blind, Elementary School for the Deaf, Junior-Senior High School for the Deaf, the Vocational Department, the Physical Education Department, and necessary support services. While these Schools are served by the superintendent and business office, each School has its own faculty and staff. Residential programs provide care for students after normal school hours. The school year closely parallels that of the other public schools. Students may go home on weekends when the parents make the necessary arrangements for transportation. The School provides transportation on designated home-going weekends.

The Schools for the Deaf

Most deaf children come to school without language or speech. Thus, it is often necessary that the deaf child spend two or three years in a preparatory class prior to entering first grade. During this time he receives a heavy concentration of vocabulary, speech lipreading, and auditory training - an emphasis which continues through this school years. As he progresses through school, the deaf student learns the same subjects as is found in the public schools, but has additional instruction in language development, speech, speech reading, and auditory training. Not all deaf children develop

lipreading or intelligible speech abilities. In later years, emphasis is placed on speech correction and more fluent speech patterns. Total communication is encouraged in the classroom and vocational areas.

Visual aids are used throughout the school programs. Overhead projectors and film strip projectors are in many classrooms and shops. Movie projectors are used frequently. The West Virginia School for the Deaf, which is a depository for captioned films for the deaf, has hundreds of these films on numerous subjects.

ARKANSAS SCHOOL FOR THE DEAF
Little Rock, Arkansas 72203

Superintendent - Mr. Tom J. Hicks

Lower School
Principal - Susan Pack

Middle School
Principal - Jerrie Finch

Center Teachers	Levels
Katherine Burns	5th
Andy Garner	6th
Mildred Pieshure	7th
Ann Schlat	4th
Horst Wasserman	3rd

SFHI Field Supervisor - Daniel Burch

General Description of Center

Education of the deaf in Arkansas began in 1850 at Clarksville, Arkansas. The Arkansas School for the Deaf was established at the present location in downtown Little Rock in 1867. The 40 acre campus containing 20 buildings is the only residential facility in the state for hearing impaired children. Financial support for the school's approximately 200 faculty and support staff and 360 students comes from state, 87%, and federal funds, 13%.

ASD offers a statewide home intervention program for hearing impaired children from birth to 4½ years of age, and a residential school program for hearing impaired state students ages 4 through 21. A day school program is available for local students ages 2 through 21.

ASD Facility and Program

The education program is divided into four levels: half day preschool class (not residential), ages 2-4; Lower School, ages 4-11; Middle School, ages 12-15; and Upper School, ages 16-21. Accreditation for the school program is from the Arkansas Department of Education and the Conference of Executives of American Schools of the Deaf. Job placement and follow up of all students who leave the school is done in cooperation with the Arkansas Department of Social and Rehabilitative Services.

The education program at ASD is offered through the use of oral, manual, and media oriented communication. Campus wide closed circuit television network and studio facilities aid in this process. In addition to a special multi-handicapped academic program for students who have needs in addition to their deafness, a full vocational program for skill training in nine vocational areas is available leading to a high school diploma.

APPENDIX D

EVALUATION INSTRUMENTS

1.1 Student Background Information File

1.2 Science Interest Survey

1.3 Cognitive Developmental Level Interviews Report Form

1.4 Cognitive Developmental Level Inventory Report Form

2.1 Lesson Adaptation Report

2.2 Cluster Adaptation Report

2.3 Student Wrap Up Record Report

2.4 Coordinator's Comments on Specific Lesson Observed During Visit Report

2.5 Coordinators Visitation Report

2.6 Coordinators Report Form - Interim and Final

2.7 Videotape Record of Sample Lessons

SCIENCE FOR HEARING IMPAIRED

Variable Identification

Variable	Code	Card ID
1. Background Variables		
Student Code Number	CODE	101-Arkansas 201-Wash. D.C. 301-Romney, WV
Age in years	AGE	-----
Grade level text used	GR	-----
Sex	SEX	1=Female 2=Male
Home Community Type	HCT	1=Rural 2=Suburban 3=Urban
Student Hearing Level in db's	DB	-----
Use of amplification aids	AMP	1=None presenf 2=Present
Parents Hearing-Deafness	DPAR	1=Both Hearing 2=One Hearing 3=Both Deaf
Standardized Reading Achievement 1977-1981 (Stanford Achievement Test)	RD 81-77	-----
Standardized Science Achievement 1977-1981 (Stanford Achievement Test)	SC 81-77	-----
Trial Center	CTR	1=Romney 2=Kendall 3=Arkansas
Teacher	TCH	0-3=Romney 4=Kendall 5-9=Arkansas

2. Inventory of Developmental Tasks		
Pre test	FTOT	V1-V72
Post test	FPOTOT	V101-V172
Sub Scores		
Quantity	QUA	V1-4
Levels	LEV	V5-8
Sequence	SEQ	V9-12
Weight	WEI	V13-16
Matrix	MAT	V17-20
Symbols	SYM	V21-24
Perception	PER	V25-28
Movement	MOV	V29-32
Volume	VOL	V33-36
Seriation	SER	V37-40
Rotation	ROT	V41-44
Angles	ANG	V45-48
Shadows	SHA	V49-52
Classes	CLA	V53-56
Distance	DIS	V57-60
Inclusion	INC	V61-64
Inference	INF	V65-68
Probability	PRO	V69-72
3. Science Interest Inventory		
Pre test	INTTOT	V201-241
Post test	INTPOTOT	V301-341

Sub Scores

Science Lesson	L	1,2,22,33
Science teacher	ST	8,17,36,38
Science teaching method	M	4,22,25,30,35
Scientists	SCT	6,13,16,29,37
Science Interest	SI	7,14,20,26,27
School	S	3,15,24,31,34
Scientific Enterprise	SE	10,18,19
Science Career	SC	11,12,21,32,40
Definitions	D	5,9,23

4. Piaget's Developmental Interview Tasks

Pre (10 tasks)	PRTTOT	V401-410
Post (10 tasks)	POTTOT	V501-510

Sub Scores

Sequence of length	V1
Classification	V2
Conservation of Matter	V3
Conservation of Volume	V4
Conceptualization of Water Level	V5
Conservation of Weight	V6
Displacement of Volume	V7
Proportionality	V8
Control of Variables	V9
Combinatorial Reasoning	V10

SCIENCE INTEREST SURVEY

DIRECTIONS

The purpose of this survey is to find out what you feel and think about science as it is taught in your school and how important you think it is in the world today. This survey contains a number of statements about science. We want to know whether you agree with them. This is not a test. There are no right or wrong answers. We would like you to give your own feelings toward each of the statements in the survey.

Please fill in your name, date, and teacher's name below.

Name _____

Today's Date _____

Teacher's Name _____

Practice Questions

1. Reading a book is fun.

   agree not sure disagree

   The answer 'agree' was chosen by circling the word agree. If your answer was "not sure" you would have circled the words, not sure.

Now try another practice questions. Do this one yourself. Select one answer by circling your choice.

2. Math should be taught to girls and boys who like it.

   disagree not sure agree

Statements on the next pages look like the practice statements. When you read each one, decide whether you agree, disagree, or are not sure. Then find the answer below the question and circle your choice. Choose only one answer for each statement. Erase clearly any answer you wish to change. Do not take too long on any one statement. Try to give an answer to all the statements.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

---

1. Science classes are a waste of time.

   disagree not sure agree

2. I like other lessons better than science lessons.

   agree not sure disagree

3. I do not want to go to school.

   agree not sure disagree

4. There are too many things to remember in science class.

   disagree not sure agree

5. Scientists are people who are good at finding out about nature and how things work.

   agree not sure disagree

6. Scientists make things that do not help me.

   disagree not sure agree

7. I want a piece of scientific equipment for a present (a small telescope, microscope or another science tool).

   agree not sure disagree

8. I like my science teacher.

   disagree not sure agree

9. Finding out why stars give off light (shine) is a scientific discovery.

   agree not sure disagree

10. Scientific discoveries help people.

    disagree not sure agree

11. My mother wants me to be a scientist.

    agree not sure disagree

12. I want to work with people who make scientific discoveries.

    disagree not sure agree

13. Scientists waste money.

    agree not sure disagree

14. Most people are not interested in science.

disagree not sure agree

15. School is fun.

agree not sure disagree

16. More money should be given to help scientists in their work.

disagree not sure agree

17. My science teacher makes our class interesting.

agree not sure disagree

18. Too much money is spent on science in the United States.

disagree not sure agree

19. Science helps solve problems and makes life better for us.

agree not sure disagree

20. I am not good in science.

agree not sure disagree

21. I do not want to be a scientist.

disagree not sure agree

22. I want to do science experiments in school.

agree not sure disagree

23. Scientists perform science experiments when they try to solve problems.

disagree not sure agree

24. I like my school.

agree not sure disagree

25. Doing experiments in science helps me understand it.

disagree not sure agree

26. I like to talk to my friends about scientific discoveries.

agree some disagree

27. I like to do science when I am not in school.

disagree not sure agree

28. Science is hard.

agree not sure disagree

29. Scientists solve many problems.

agree not sure disagree

30. I like to do experiments in science more than only read about them.

disagree not sure agree

31. I like the teachers in this school.

agree not sure disagree

32. My father wants me to be a scientist.

disagree not sure agree

33. I like to go to science class.

agree not sure disagree

34. School is boring.

agree not sure disagree

35. I like to do science experiments more than listening to the teacher tell about them.

agree not sure disagree

36. I enjoy working for my science teacher.

disagree not sure agree

37. Scientists are "show offs".

agree not sure disagree

38. My science teacher is one of the nicest teachers in the school.

disagree not sure agree

39. Next year I want to learn more science.

agree not sure disagree

40. When I grow up I want to be a dancing or sports star, not a famous scientist.

disagree not sure agree

41. I want a science book for a present.

agree not sure disagree

Science Interest Survey

Content Factors

L	Science Lessons (4)	1, 2, 28, 33
ST	Science Teacher (4)	8, 17, 36, 38
M	Science Teaching Method (5)	4, 22, 25, 30, 35
Sct.	Scientists (5)	6, 13, 16, 29, 37
SI	Science Interest (7)	7, 14, 20, 26, 27, 39, 41
S	School (5)	3, 15, 24, 31, 34
SE	Scientific Enterprise (3)	10, 18, 19
SC	Science Career (5)	11, 12, 21, 32, 40
D	Definitions (3)	5, 9, 23

COGNITIVE DEVELOPMENTAL LEVEL INTERVIEW FORM

Name _____ Interviewer's Name _____

Age _____ Class _____ School _____

I. Assessment Results

Task description (e.g. conservation of matter, classification, proportionality, etc.)	Achievement Give Level of task achievement	Thought process(es) used by child in attempting to solve a problem (e.g. reversibility, proportional reasoning, and ego centrism)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

II. Summary Diagnosis

Stage	Number and Level of Tasks Achieved	Thought processes exhibited at each level
Preoperational		
Concrete-operational		
Formal-operational		

Piaget Inventory Answer Sheet

Name _____ Date _____ (month day year)

School _____ City _____

Grade (or class) ___ Boy Girl (circle one) Age ___ Birthdate _____ (month day year)

Do not write in the booklet. Circle the correct answer.

Example Quantity	A	(B)	C	D	
1.	A	B	C	D	
2.	A	B	C	D	
3.	A	B	C	D	
___ 4.	A	B	C	D	
Example Levels	A	(B)	C	D	
5.	A	B	C	D	
6.	A	B	C	D	
7.	A	B	C	D	
___ 8.	A	B	C	D	
Example Sequence	A	B	(C)	D	
9.	A	B	C	D	
10.	A	B	C	D	
11.	A	B	C	D	
___ 12.	A	B	C	D	
Example Weight	A	B	(C)	D	
13.	A	B	C	D	
14.	A	B	C	D	
15.	A	B	C	D	
___ 16.	A	B	C	D	
Example Matrix	A	B	C	(D)	
17.	A	B	C	D	
18.	A	B	C	D	
19.	A	B	C	D	
___ 20.	A	B	C	D	
Example Symbols	A	B	(C)	D	
21.	A	B	C	D	
22.	A	B	C	D	
23.	A	B	C	D	
___ 24.	A	B	C	D	

Example Persp.	(A)	B	C	D	
25.	A	B	C	D	
26.	A	B	C	D	
27.	A	B	C	D	
___ 28.	A	B	C	D	
Example Movement	A	B	(C)	D	
29.	A	B	C	D	
30.	A	B	C	D	
31.	A	B	C	D	
___ 32.	A	B	C	D	
Example Volume	(A)	B	C	D	
33.	A	B	C	D	
34.	A	B	C	D	
35.	A	B	C	D	
___ 36.	A	B	C	D	
Example Seriatn.	A	(B)	C	D	
37.	A	B	C	D	
38.	A	B	C	D	
39.	A	B	C	D	
___ 40.	A	B	C	D	
Example Rotation	(A)	B	C	D	
41.	A	B	C	D	
42.	A	B	C	D	
43.	A	B	C	D	
___ 44.	A	B	C	D	
Example Angles	A	B	(C)	D	
45.	A	B	C	D	
46.	A	B	C	D	
47.	A	B	C	D	
___ 48.	A	B	C	D	

Example Shadows	A	B	C	(D)	
49.	A	B	C	D	
50.	A	B	C	D	
51.	A	B	C	D	
___ 52.	A	B	C	D	
Example Classes	(A)	B	C	D	
53.	A	B	C	D	
54.	A	B	C	D	
55.	A	B	C	D	
___ 56.	A	B	C	D	
Example Distance	(A)	B	C	D	
57.	A	B	C	D	
58.	A	B	C	D	
59.	A	B	C	D	
___ 60.	A	B	C	D	
Example Inclusn.	A	B	(C)	D	
61.	A	B	C	D	
62.	A	B	C	D	
63.	A	B	C	D	
___ 64.	A	B	C	D	
Example Infer.	A	(B)	C	D	
65.	A	B	C	D	
66.	A	B	C	D	
67.	A	B	C	D	
___ 68.	A	B	C	D	
Example Prob.	(A)	B	C	D	
69.	A	B	C	D	
70.	A	B	C	D	
71.	A	B	C	D	
___ 72.	A	B	C	D	

Total ___

NAME _____

ADAPTATION REPORT FORM

DATE 5

LESSON

LESSON TITLE _____ LESSON CLUSTER _____ GRADE _____

HEADING	ALL RIGHT AS IS	CHANGE NEEDED	SPECIFIC CHANGE NEEDED
Purpose	☐	☐	
Prerequisites	☐	☐	
Advance preparation	☐	☐	
Teaching Suggestions	☐	☐	
Desired learning outcome	☐	☐	
Key Signs	☐	☐	

Time to Complete Lesson _____

OTHER COMMENTS: _____

(Use other side if needed.)

NAME _____

DATE _____

LESSON CLUSTER _____

GRADE LEVEL _____

ADAPTATION REPORT FORM

CLUSTER

HEADING	ALL RIGHT AS IS	CHANGE NEEDED	SPECIFIC CHANGES NEEDED
A. Cluster Outline	☐	☐	
B. Materials	☐	☐	
C. Teaching Strategy	☐	☐	
D. Evaluation - Wrap Up	☐	☐	

E. Overall Effectiveness of adaptations made to cluster (Check level, ✓)

Additional adaptation needed for Hearing Impaired

0 1 2 3 4 5

Adapted curriculum allows for main cluster goals to be learned. No change needed.

OTHER COMMENTS: _____

(Use other side if needed.)

LESSON TITLE _____ GRADE _____

LESSON CLUSTER _____

Student "Wrap Up" Record Sheet

Student Name	Reading Problem	Question Number 1	2	3	4	5	6	Other Problems
1.								
2.						✓		
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
	e.g. vocabulary, reading comprehension, expressive language difficulty (writing speaking, signing or mime)	Thought Process required						e.g. Thinking required too high order, very short attention span, behavioral disorder, absent too often, or motor impairment

Key

\+ Correctly answered
✓ Partially answered
\- Incorrectly answered

NAME _____

DATE _____

Coordinator_____

Date_____

Coordinator's Comment[redacted] Specific Lesson Observed during Visit

Cluser_____ Grade level_____

Name of Lesson_____ No. of students_____

Teacner observed_____

1. How closely does teacher follow the adapted lesson?

   -use of language cards
   -inclusion of all adapted teacher suggestions
   -eliminate any suggestions and if so why?
   -etc.

2. General observation of the lesson.

   -Do all students become actively involved in the activities?
   -Do some students fail to understand basic idea of lesson?
   -etc

3. Teacner commens on specific lesson

4. Student Input - Interview students before, during and/or after lessons, student comments overheard.

   a. Student attitude toward the curriculum

      -Does the student enjoy learning science & why
      -Do they like working with the material
      -etc

   b. Student understanding of basic objectives of lesson

      -Do they know what they are doing?
      -Do they know why they are doing the activities?
      -etc

   c. Other Student Comments

5. Rating of School and Classroom environment observed during visit

-materials readily available
-students encouraged to explore materials out of class time
-room inviting, science atmosphere, posters, displays
-students happy to come to science class
-etc

6. Rating of Instruction Quality and Type observed during visit

-see separate observational checksheet
-other comments

7. Rating of quality of communication

-clarity of signs and visible speech
-smoothness of signs
-facility with signing
-do the students appear to understand teacher
-etc.

8. Comments on events in the school observed during or before visit

-school events disruptive to science schedule
-school events disruptive to classroom learning
-science carry-over to other classes or to events outside of school day

9. Other Comments

COORDINATOR_____

DATE_____

GRADE OBSERVED_____

COORDINATOR'S VISITATION REPORT

General (use additional space if needed - staple all pages)

1. Teacher's overall attitude toward adapted curriculum
   - is she/he happy using the curriculum
   - is it worth the trouble
   - do they think the students like the lessons
   - etc.

2. Specific problems with the curriculum
   - too much emphasis on reading
   - inadequate adaptations for hearing impaired
   - concepts too difficult
   - prerequisites in science too important
   - lessons inadequate, i.e. teachers must add to the cluster in order to achieve goals
   - lessons too long
   - etc.

3. Teacher questions

4. Teacher suggestions

5. Areas that the teacher feels has worked especially well

6. Other general comments.

COORDINATOR REPORT FORM

INTERIM AND FINAL

COORDINATOR_____ TEACHERS OBSERVED_____

DATE_____ GRADE LEVELS_____

(3 required Sept., Dec., April)

Use additional space if need for response - staple all pages.

1. Describe role of coordinator to date.

2. Evaluation of center activities and curriculum to date.

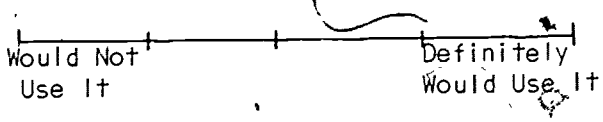
3. Relationship with staff of school.

4. Teachers' attitude and judgements.
   a. Overall judgement of effectiveness of curriculum to date.

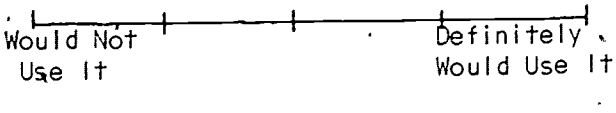
   b. Has using this curriculum changed their attitude toward teaching science.

   c. Has using this curriculum changed their emphasis on student goals in science teaching. If so, how?

   d. Would they be interested in using this curriculum in the future? If so, how much?



   e. How would they perceive other science teachers of the hearing impaired reacting to this curriculum?



Why?

f. How does this curriculum compare with other curricula they have used in the past?
In what ways are other curricula different?

g. Overall judgement of effectiveness of this curriculum adaptation in helping these teachers to teach science with the hearing impaired.

h. 1) List some ares of adaptation of curricula these teachers regularly make that <u>are found</u> in this adaptation.

2) List some areas of adaptation of curricula these teachers regularly make that <u>are not found</u> in this adaptation.

3) List some needed areas of adaptation of curricula these teachers do not regularly make that <u>are found</u> in this adaptation.

5. Other comments from the teachers or your self which may be of help in making changes in the curriculum adaptation to produce a final form.

COORDINATOR _____

Videotape Records of Sample Lessons

Videotapes will be made by coordinators during their classroom visits. Lessons tapes will be analyzed for classroom interaction and teacher activities. 4 lessons of each teacher will be made during the year.

Times for taping are:

1) during first month, August-September
2) during second month, October
3) during fourth month, December or January
4) during eighth month, March.

TAPED LESSONS

Tape	Date	Teacher	Grade	Time of Lesson	Lesson and Cluster Title	Comments
1						
2						
3						
4						

APPENDIX E

MEDIA MATERIALS GUIDE TO ACCOMPANY USE OF SFHI PROGRAM

LEVELS 3-7

MEDIA KITS USED WITH THE SFHI PROGRAM*

Correlation of Media Activities in Science (MAS) Produced by Houghton Mifflin Company to be used with Science Program

Review: The MAS A-V program consists of 16 kits. Usually a kit contains 3 color filmstrips, sound cassettes, duplicating master, pupil response sheets, and a teacher's guide.

The cassette accompanying a filmstrip has two sides. The "enrichment" side provides more detail. The alternate side has the "bare bones" and would be most suitable when accompanied by signing.

The response sheets allow for self-testing and for recording data from observations and problem-solving sequences in the filmstrips. These sheets are suitable for use by individual pupils, by small groups, or by the entire class together. The teacher's guide provides an overview, lists the behavioral patterns, summarizes the content, and gives specific teaching suggestions.

Correlation: There are a few minor problems with some individual filmstrips, problems that are noted in the "Comment" column of the correlation chart. Occasionally kits are appropriate for more than one unit in SFHI and, therefore, appear more than once in the chart.

*Media Activities in Science (MAS) information or kits can be obtained by writing Houghton Mifflin Co., One Beacon St., Boston, MA 02197.

LEVEL	SFHI OR SCIENCE	MAS A-V KIT/FILMSTRIP TITLE	COMMENT
3	Unit 1: Variation	VI. Variation: Variation in Properties, Estimating, Predicting	Recommended with reservation because English units are used rather than metric units in Estimating.
	Unit 2: Space and	VII. Place and Motion: Position, Motion, Relative Position and Motion XI. Motion and Change: Mystery Tracks Clouds and Weather, Moving Water	Relative Position and is challenging and more appropriate for Level 5. Use only Mystery Tracks with Unit 2. (See Level 4, Unit 3.)
	Unit 3: Interaction	VIII: Moving and Mixing: Systems and Variables, Subsystems and Variables, Taking Part in a System	Difficult. Suitable for the gifted learner. Introduces the concept of "subsystem" which is not in the text

LEVEL	SFHI OR SCIENCE UNIT TITLE	MAS A-V KIT/FILMSTRIP TITLE	COMMENT
3	Unit 4: Population Interactions	XIII. Interaction in a Population: Life in a Pond, Life at the Seashore, Life in Fields and Woods	
4	Unit 1: Environ-	XIII. Interaction in a Population Life in a Pond, Life at the Seashore, Life in Fields and Woods	
	Unit 2: Exploring Matter	II. Materials: Solids, Liquids, Gases X. Structural Systems: Structure and Function, Layered Structures, Skeleton Structures	Use only Structure and Function and Layered Structures from Kit X.
	Unit 3: Patterns	X. Structural Systems: Structure and and Function, Layered Structures, Skeleton Structures XI. Motion and Change: Mystery Tracks, Clouds and Weather, Moving Water	Use only Skeleton Structures from Kit X.
	Unit 4: Exploring	XII. Conduction Systems: Sound Systems Heat Systems, Electrical Systems	There is an error in Heat Systems - the narration tells the wrong times as shown on the clocks in frames 19 and 20.
5	Unit 1: Adaptations	X. Structural Systems: Structure and and Function, Layered Structures, Skeleton Structures XVII. Adaptations: Frogs and Toads, Birds, Plants	Use only Skeleton Structures
	Unit 2: Forces	XVI. Pushes and Pulls: Moving Systems, Levers, Stopping Systems	
	Unit 3: Motion	VII. Place and Motion: Position, Motion, Relative Position and Motion XV. Relative Motion: Position and Motion, Reference Frames and Axes, Relative Motion and You	

LEVEL	SFHI OR SCIENCE UNIT TITLE	MAS A-V KIT/FILMSTRIP TITLE	COMMENT
5	Unit 4: Matter and Energy	(None)	
6	Unit 1: Population Needs	XX. Population Needs: Producers and Consumers, Success in a Population	
	Unit 2: Models	XIV. Size, Scale, and Models: Estimating Size, Scales and Scale Models, Maps and Map Scales XIX. Models: Inferring with Models, Models and Sounds, Making Your Own Models	
	Unit 3: Models of	XVIII. Invisible Systems: What Do You See? Invisible Systems You Use, Interaction with Invisible Systems	Not too closely related, but helpful nevertheless.
	Unit 4: Energy and Ecosystems	XII. Ecological Interactions: Ecosystems, Unbalanced Ecosystems, Measuring Pollution	Measuring Pollution uses the term "weight" rather than the term "mass".

Other Media Useful with the SFHI Program

Captioned films and filmstrips can obtained by writing

Captioned Films for the Deaf, Distribution Center, 5034 Wisconsin Ave., N.W. Washington, D.C. 20016.

National Geographic Society, P.O. Box 1269, Washington, D.C. 20017. Write for a list of excellent captioned filmstrips.

Research for Better Schools, Inc., 1700 Market St., Philadelphia, PA 19103. Write for information on Teachers Guide/Activity Set and captioned filmstrip on science careers, "Is Science a Possible Career for You?".